C-Size VXIbus Systems

Configuration Guide

Where to Find it - Online and Printed Information:

System installation (hardware/software)	This Manual Agilent VIC (VXI installation software)
Module configuration and wiring	Module User's Manual
SCPI programming	Module User's Manual
SCPI example programs	Module User's Manual
SCPI command reference	Module User's Manual
Register-Based Programming	Module User's Manual
VXI*plug&play* programming	VXI*plug&play* Online Help
VXI*plug&play* example programs	VXI*plug&play* Online Help
VXI*plug&play* function reference	VXI*plug&play* Online Help
Soft Front Panel information	VXI*plug&play* Online Help
VISA language information	Agilent VISA User's Guide
Agilent VEE programming information	Agilent VEE User's Manual

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Edition 1 Rev 2

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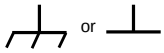
Edition 1 Rev 2 (Part Number E1406-90028) . . . . . July 2006

Safety Symbols

Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.

Indicates the field wiring terminal that must be connected to earth ground before operating the equipment—protects against electrical shock in case of fault.



Frame or chassis ground terminal—typically connects to the equipment's metal frame.

Alternating current (AC).

Direct current (DC).

Indicates hazardous voltages.

WARNING Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

DO NOT service or adjust alone: Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

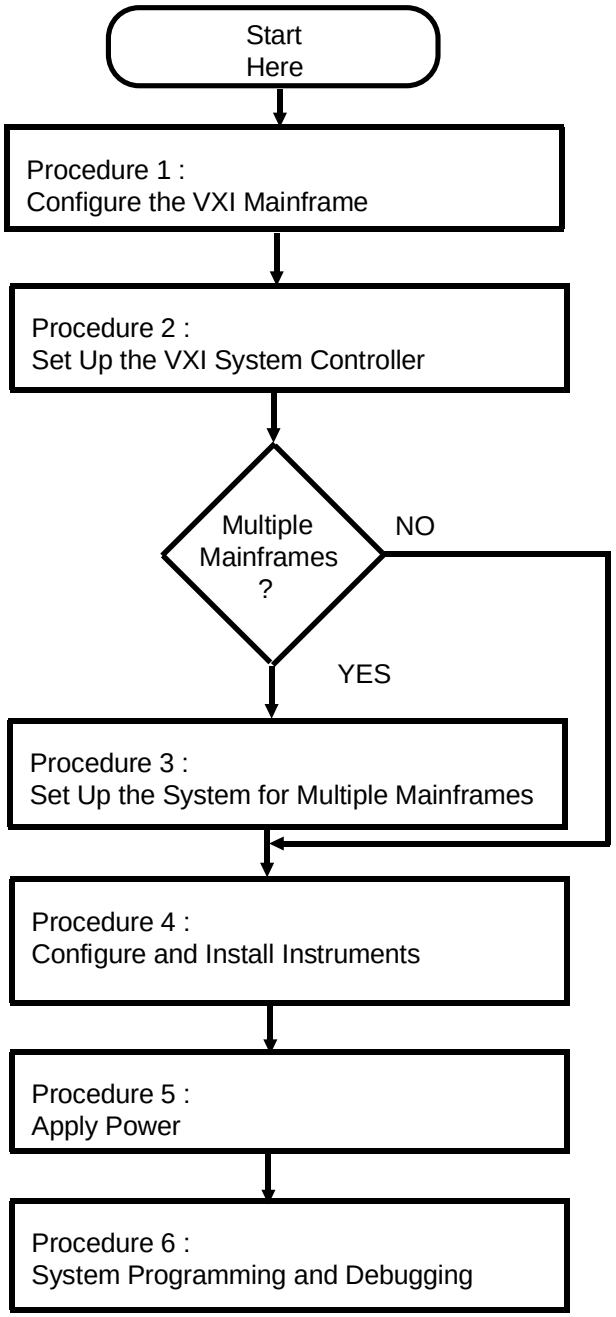
Notes

Notes

Using the C-Size Configuration Guide and Agilent VIC

Our goal is to make installation of your C-Size VXI system as easy as possible. To do so, Agilent VIC (Agilent VXI Installation Consultant) is provided with the Agilent E1406 Command Module. Agilent VIC is a Microsoft® Windows™ 3.1 program that helps you configure and install Command Module - based VXI systems. If your system contains an Agilent E1406 Command Module to be controlled by a computer external to the VXI mainframe, we recommend that you configure your system using Agilent VIC. For all other configurations, or if you do not have Agilent VIC, use this configuration guide in the sequence shown.

Configuration Guide Sequence:


Start Here
Procedure 1 : Configure the VXI Mainframe
Procedure 2 : Set Up the VXI System Controller
Multiple Mainframes ?
NO
YES
Procedure 3 : Set Up the System for Multiple Mainframes
Procedure 4 : Configure and Install Instruments
Procedure 5 : Apply Power
Procedure 6 : System Programming and Debugging

This procedure describes how to prepare your Agilent Mainframe for operation.

This procedure describes how to set up communication between your controller and the instruments in the VXI mainframe. Configurations for five different controller platforms are described.

This procedure describes how to set up your Agilent E1482B VXIbus Extender Modules when you have multiple mainframes communicating via MXIbus.

This procedure describes how to configure instruments for your VXIbus system. Instrument addressing and installation are also described in this procedure.

This procedure describes the power-on sequence and what to look for to confirm proper installation.

This procedure shows you how to start programming your VXIbus system.

For More Information

This manual describes how to get a C-Size VXIbus System up and running quickly. You may require information from other manuals. The following list describes other manuals you may need to refer to.

- To find additional information on the Agilent E1406/05 Command Module:

  Agilent E1406A Command Module User's Manual (E1406-9000x)

- To find operating and programming information on Agilent plug-in modules:

  Refer to the manual that came with the module (E14xx-9000x or (E13xx-9000x)

- To find information on the Standard Commands for Programmable Instruments language (SCPI):

  Beginner's Guide to SCPI Available from Addison-Wesley Publishing at 1-800-822-6339

- To find information on installing the Agilent E1489I MXIbus Controller Interface Card in an HP 9000 Series 700 Computer:

  Agilent E1489I MXIbus Controller Interface For HP 9000 Series 700 workstations installation Guide and Overview

- To find information on Agilent Compiled SCPI

  Agilent E1570A/B E1572A Compiled SCPI for HP-UX
  Agilent E1571A Compiled SCPI for MS-DOS

- To find information on the VISA Language

  Agilent VISA User's Guide

Terms Used In This Manual

The following is a list of terms used in this manual. For more information on these terms, see Appendix A, "Terms and Definitions."

Bus Request Level The bus request level is a priority at which the Command Module can request the use of the data transfer bus.

Cardcage A cardcage is a VXIbus mainframe which allows instruments on a card to be plugged in and operate in a VXI environment. The Agilent E1401A Mainframe is an example of an Agilent cardcage.

CLK10 This is the 10 MHz system clock. Clk10 is usually provided by the system controller.

Command Module Primary GPIB Address The primary GPIB address identifies the GPIB port.

C-SCPI Compiled SCPI is a set of C programming tools that allow you to program register-based instruments using the high-level SCPI language.

Data Transfer Bus The data transfer bus (DTB) is used for addressing and data transfer.

Downloadable Device Drivers Device drivers enable register-based modules to be programmed from the Agilent E1406 Command Module with SCPI Commands. Some drivers are installed at the factory and other have to be installed by the user.

GPIB GPIB is Agilent Technologies' implementation of ANSI/IEEE Standard 488.1-1978 "IEEE Standard Digital Interface for Programmable Instrumentation."

Instrument In this manual an instrument refers to an instrument on a card that can be plugged into a VXI cardcage.

Logical Address The logical address is used to identify an instrument in a VXIbus system.

Mainframe A mainframe is a VXIbus cardcage which allows instruments on a card to be plugged in and operate in a VXI environment. The Agilent E1401A is an example of an Agilent mainframe.

Module A module is an instrument on a card.

Resource Manager The resource manager runs at power on and identifies all plug-in modules installed in the mainframe. The resource manager also controls commander / servant hierarchies, allocates interrupt lines, performs address mapping, and starts the system operation.

SCPI SCPI stands for Standard Commands for Programmable Instruments. It is an industry standard instrument control language that is supported by a consortium of manufacturers.

Servant Area The servant area of a commander defines a range of logical addresses in which all instruments within the address range specified report to that commander.

Secondary GPIB Address The secondary GPIB address is combined with the computer's interface select code and Command Modules primary GPIB address to form a module's complete GPIB address.

Slot 0 Device The slot 0 device locates where modules are installed in the mainframe and manages data flow across the VXIbus backplane. The system clock is also provided by the slot 0 device.

Virtual Instruments A virtual instrument is a combination of several modules that are treated as a single instrument and accessed at a single address.

VXI VXIbus is an open architecture instrument interface for cardcage instrumentation.

VXI-MXI Module A VXI-MXI Module allows you to configure multiple mainframes to function as a single VXIbus System.

Procedure 1: Configure the VXI Mainframe

This procedure describes how to configure the Agilent E1401B and Agilent E1421B VXI mainframes in preparation for installing modules and applying power. This procedure consists of the following steps:

- Connect mainframe safety ground (if necessary)
- Connect the power cord

Once you have completed the applicable steps in this procedure, continue with the next procedure, **"Procedure 2 : Set Up the VXI System Controller."**

WARNING **SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the system. Before you perform any procedures, disconnect AC power and field wiring from the mainframe.**

CAUTION **STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, use anti-static techniques whenever handling a module.**

Step-1 : Connect Mainframe Safety Ground (if necessary)

When operating the Agilent 1401B or E1421B at **mains frequencies greater than 66 Hz**, you must connect a safety ground.

Warning **For protection from electrical shock when operating at mains frequencies greater than 66 Hz, connect the chassis ground terminal to permanent earth ground.**

Avertissement **Risque de Choch électrique. Si la fréquence du secteur est supérieure à 66 Hz, relier la borne de masse du chassis à une prise de terre fixe.**

Grounding Procedure

Connect a 16 AWG (1.3 mm or larger) wire to the PEM nut shown below. The wire must be green with a yellow stripe or bare (no insulation). Use an M4 x 10 screw, grounding lug, and toothed washers (or toothed lug) as shown in the figure on the following page. Securely attach the other end of the wire to a permanent earth ground using toothed washers or a toothed lug.

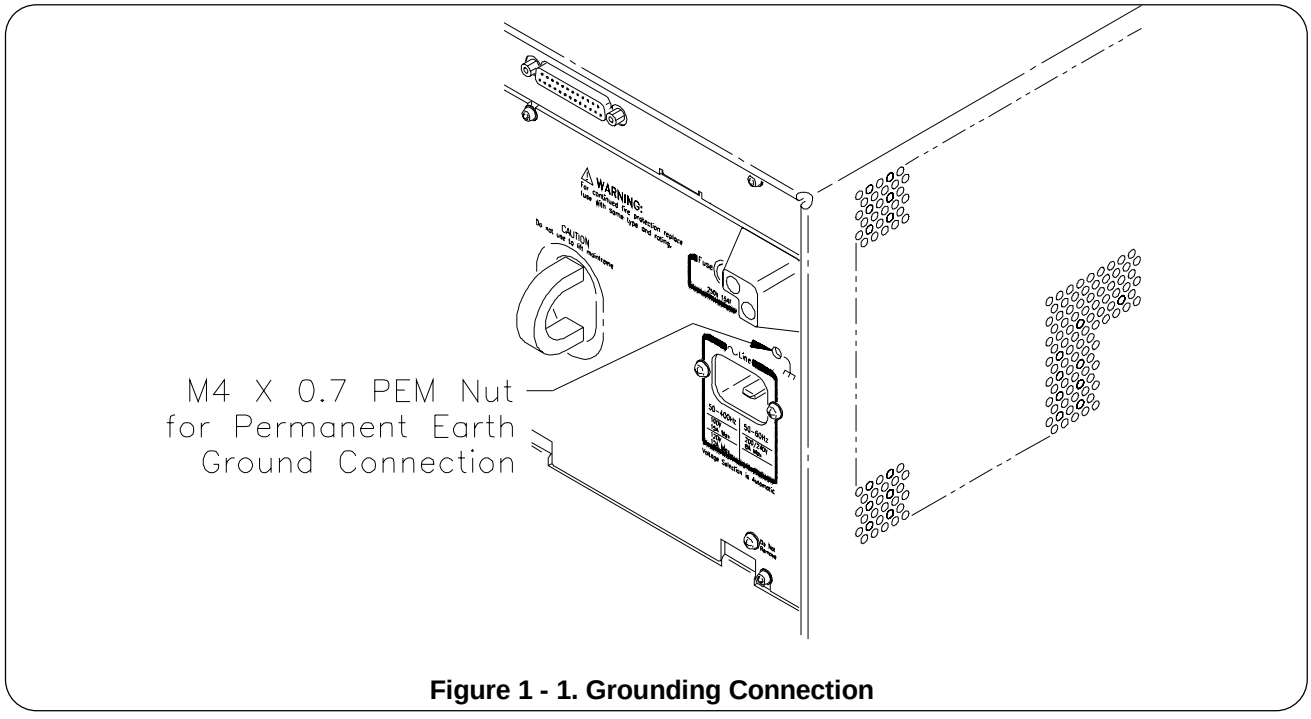


Figure 1 - 1. Grounding Connection

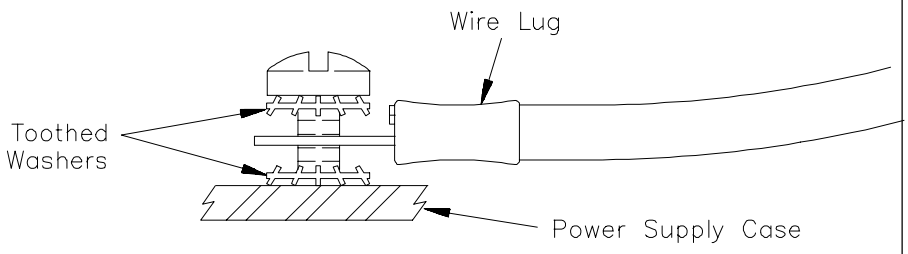
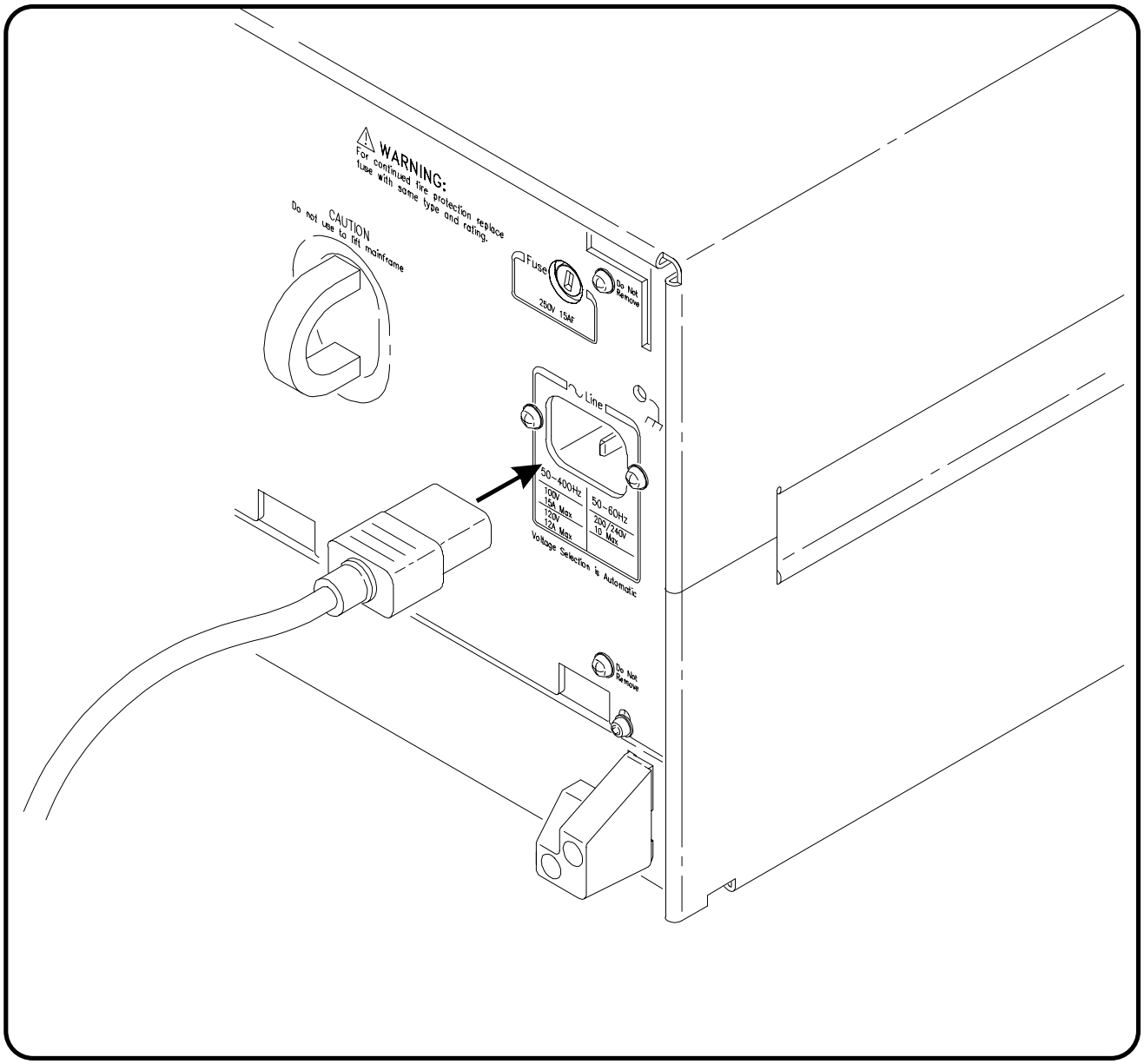


Figure 1 - 2. Grounding Screw, Toothed Washers

Step-2 : Connect the Power Cord



Step-3 : Where To Go Next

If you have additional mainframes repeat this procedure until all mainframes are configured. Once configured, continue with the following procedure:

- **"Procedure 2 : Set Up the VXI System Controller"**

Procedure 2:
Set Up the VXI System Controller

The controller to VXI mainframe interface determines how commands and data will flow between the controller and the mainframe. This procedure is divided into five sections according to the controller used:

- **Setting Up the Agilent E1406A Command Module** - This section covers the setup of the Agilent E1406A Command Module connected to an external controller using the General Purpose Interface Bus (GPIB). **See Page 2-2**
- **Setting Up a Series 700 Controller** - This section covers the setup of an HP 9000 Series 700 external controller with an Agilent E1489I MXIbus Controller Interface Card connected to an Agilent E1482 VXI-MXI Bus Extender Module in slot 0. **See Page 2-18**
- **Setting Up an Embedded V743 Controller** - This section covers the setup of an Agilent E1497A/98A Embedded V743 controller with the VXIbus as the communication path. **See Page 2-35**
- **Setting Up an Embedded Agilent RADI-EPC7 486 Computer** - This section covers the setup of an Agilent RADI-EPC7 Embedded Computer with the VXIbus as the communication path. **See Page 2-49**

WARNING **SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the system. Before you perform any procedures in this guide, disconnect AC power and field wiring from the mainframe.**

CAUTION **STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, observe anti-static techniques whenever handling a module.**

Setting Up the Agilent E1406A Command Module

This procedure explains how to set up and install an Agilent 75000 Series C VXIbus system with an external computer (Personal Computer or Workstation) connected to the Agilent E1406A Command Module via GPIB. This procedure consists of the following steps:

- E1406-1 : Set the Command Module as Resource Manager
- E1406-2 : Set the Command Module as Slot 0 Device
- E1406-3 : Set the Clock Source
- E1406-4 : Set the Bus Request Level
- E1406-5 : Configure the Command Module's Shared RAM
- E1406-6 : Set the Command Module's Servant Area
- E1406-7 : Set the Command Module's Primary GPIB Address
- E1406-8 : Install the Command Module into the Mainframe
- E1406-9 : Connect Interface Cables
- E1406-10 : Apply Power
- E1406-11 : Where To Go Next

If you need information on terms used in this manual, see Appendix A, "Terms and Definitions."

Agilent E1406A Default Configuration

The following shows how the Agilent E1406A Command Module is configured at the factory. These settings are appropriate for most VXI systems. A quick verification of these settings will save you time.

Switch	Setting
Logical Address	0
Servant Area	255
GPIB Address	9
VME Bus Timer (BTO)	Enabled
Slot 0	Enabled
VME System Controller	Enabled
CLK10 Source	Internal
Bus Request Level	3
Shared RAM	Enabled (256 kB)

E1406-1 : Set the Command Module as Resource Manager

Set the Command Module as resource manager by setting its logical address to 0. (The Command Module's factory-set logical address is 0.)

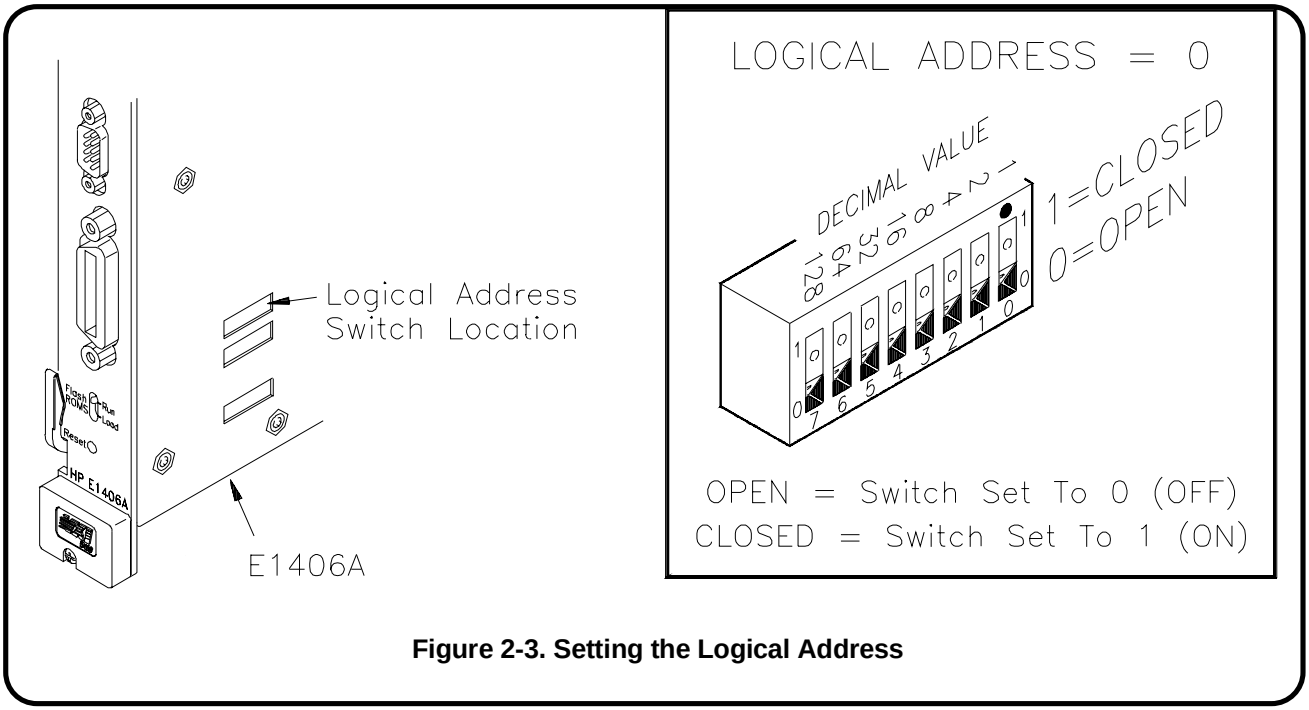


Figure 2-3. Setting the Logical Address

At power-on, the resource manager function is started. The purpose of the resource manager is to:

- identify all plug-in modules installed in the C-size mainframe
- set commander/servant hierarchies whereby one or more plug-in modules *control* other plug-in modules
- perform A24/A32 address mapping so that modules requiring additional addressing can receive it
- allocate interrupt lines to manage communication between interrupt handler modules and interrupter modules
- start system operation

Once the power-on sequence is completed and the system is started, the resource manager is no longer used. See Appendix A, "Terms and Definitions," for more information on the resource manager.

E1406-2 : Set the Command Module as Slot 0 Device

Set the following switches:

- Slot 0 switches to the "Enable" Position, and
- (VME) System Controller switch to the "Enable" Position.

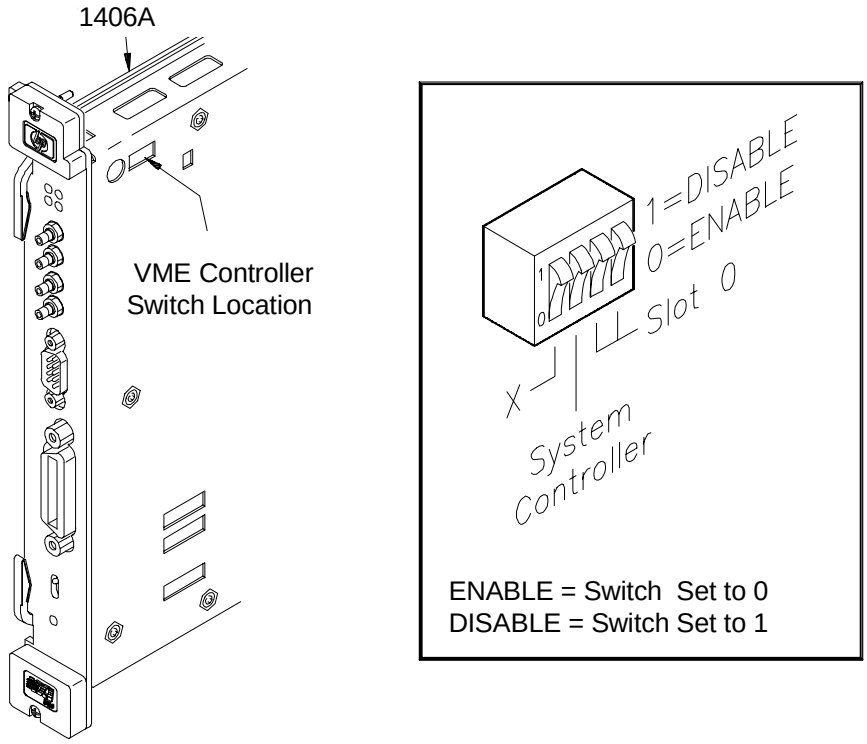


Figure 2 -4. Setting Command Module as Slot 0 Device

The slot 0 functionality is used during operation for the following purposes:

- locate where modules are installed in the mainframe
- manage (arbitrate) data flow across the VXIbus backplane busses
- provide the system clock (SYSCLK - 16 MHz)

See Appendix A, "Terms and Definitions," for additional information on the slot 0 device.

NOTE *Once the Command Module is set as the slot 0 device, it must then be installed in the mainframe's slot 0.*

E1406-3 : Set the Clock Source

Set the clock to one of the following:

- **Internal** - to use the Command Module's 10 MHz internal clock, CLK10 (factory default), or
- **External** - to use the clock supplied at the SMB faceplate connector on the Command Module.

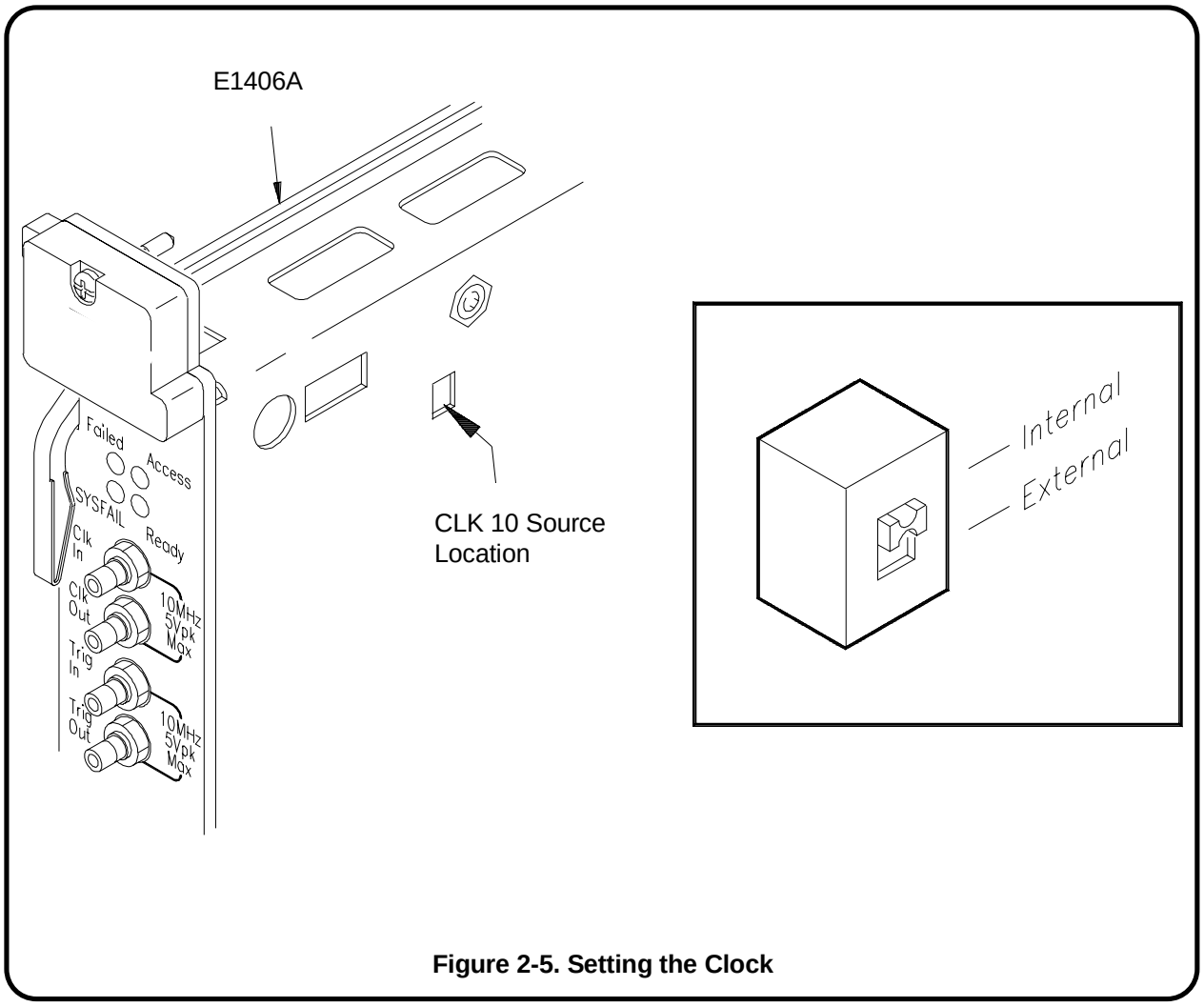


Figure 2-5. Setting the Clock

The clock is distributed to every slot along the VXIbus backplane. Disabling the slot 0 and (VME) System Controller functions removes the internal clock or external clock from the VXIbus backplane. However, the clock from either source is still present at the 'Clk Out' SMB connector.

See Appendix A, "Terms and Definitions," for more information about the Command Module CLK10.

E1406-4 : Set the Bus Request Level

The Command Module's bus request level switch is set to 3 at the factory. In most VXIbus systems and configurations, it is not necessary to change this setting.

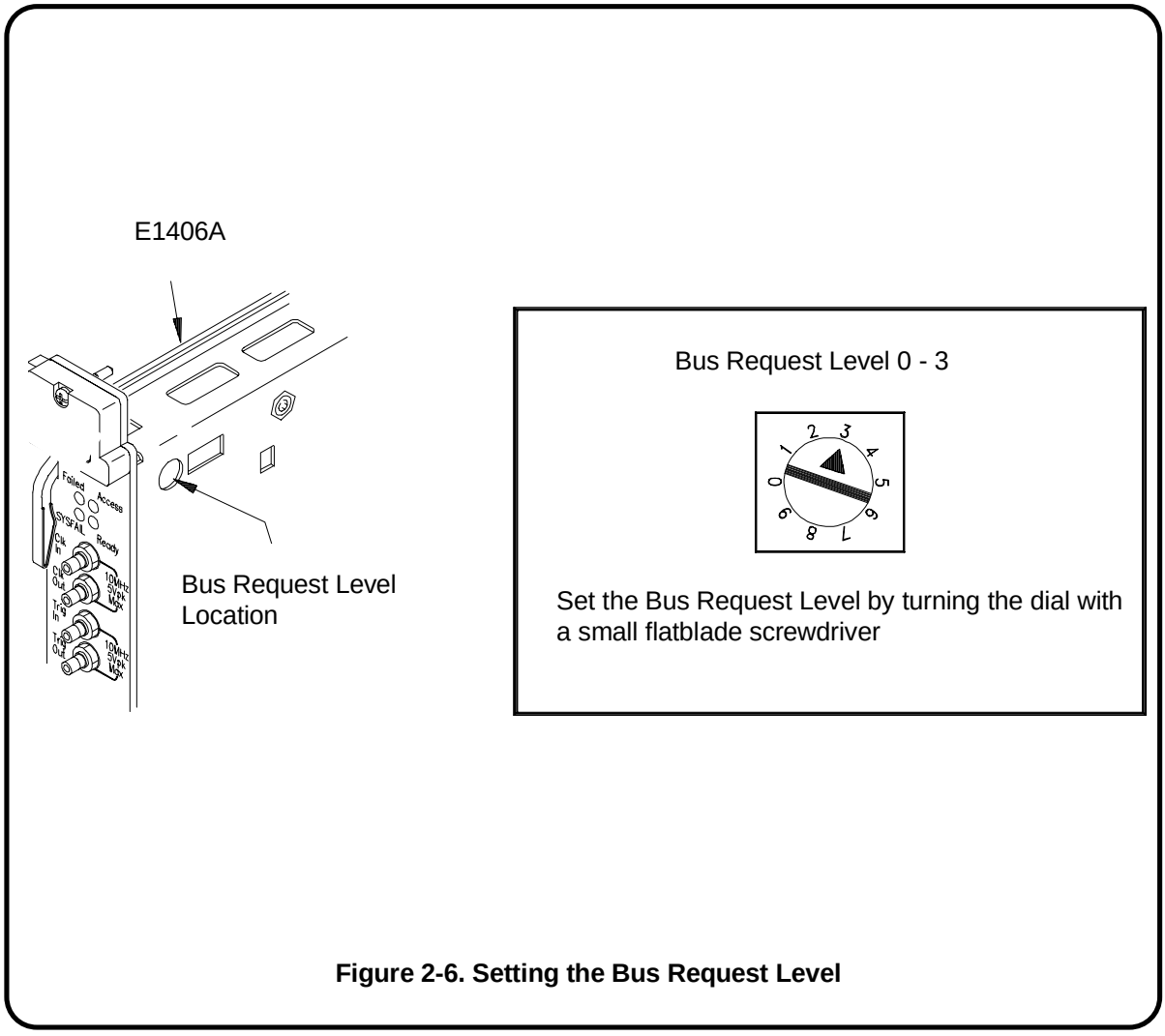


Figure 2-6. Setting the Bus Request Level

The bus request level determines the priority at which the Command Module can request the use of the Data Transfer Bus. There are four bus request levels to choose from: 0 - 3. Bus request level 3 has the highest priority; bus request level 0 has the lowest priority.

See Appendix A, "Terms and Definitions," for more information on the Bus Request Level.

E1406-5 : Configure the Command Module's Shared RAM

When the E1406A expanded memory option 010 is installed, the switch shown in Figure 2-5 is used to set one of the following configurations:

- 1 Mbyte non-volatile RAM and 256 Kbytes of shared RAM
- 2 Mbytes non-volatile RAM and 0 bytes of shared RAM

When option 010 is factory-installed, the switch is set for 1 Mbytes/ 256 Kbytes. If the Command Module contains standard memory only, setting the switch for 2 Mbytes disables the shared memory. The memory (256 Kbytes) is **not** available as non-volatile memory.

See Appendix A, "Terms and Definitions," for more information on Command Module memory allocation.

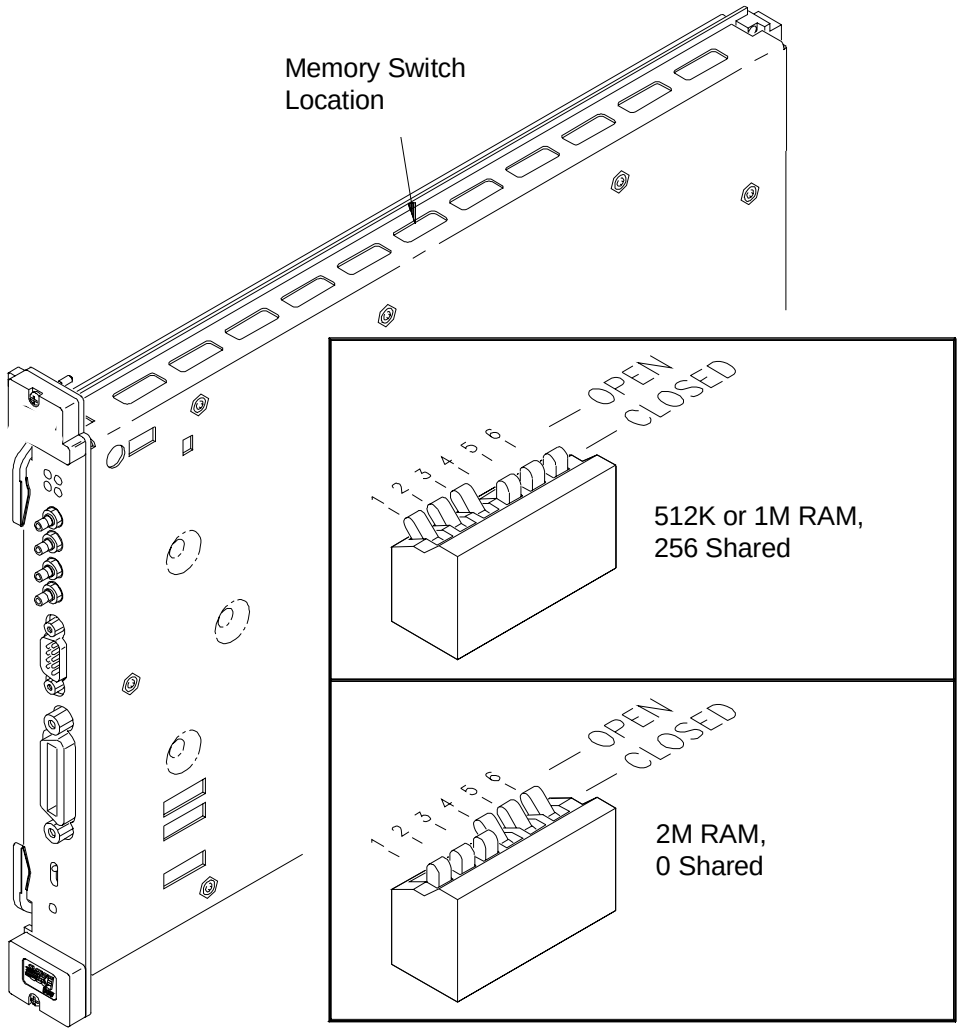


Figure 2-7. Allocating Shared RAM

E1406-6 : Set the Command Module's Servant Area

When the Command Module is the resource manager (logical address = 0), its servant area should be set to 255. Thus, the Command Module will be the (top level) commander for all modules with logical addresses between 1 and 255.

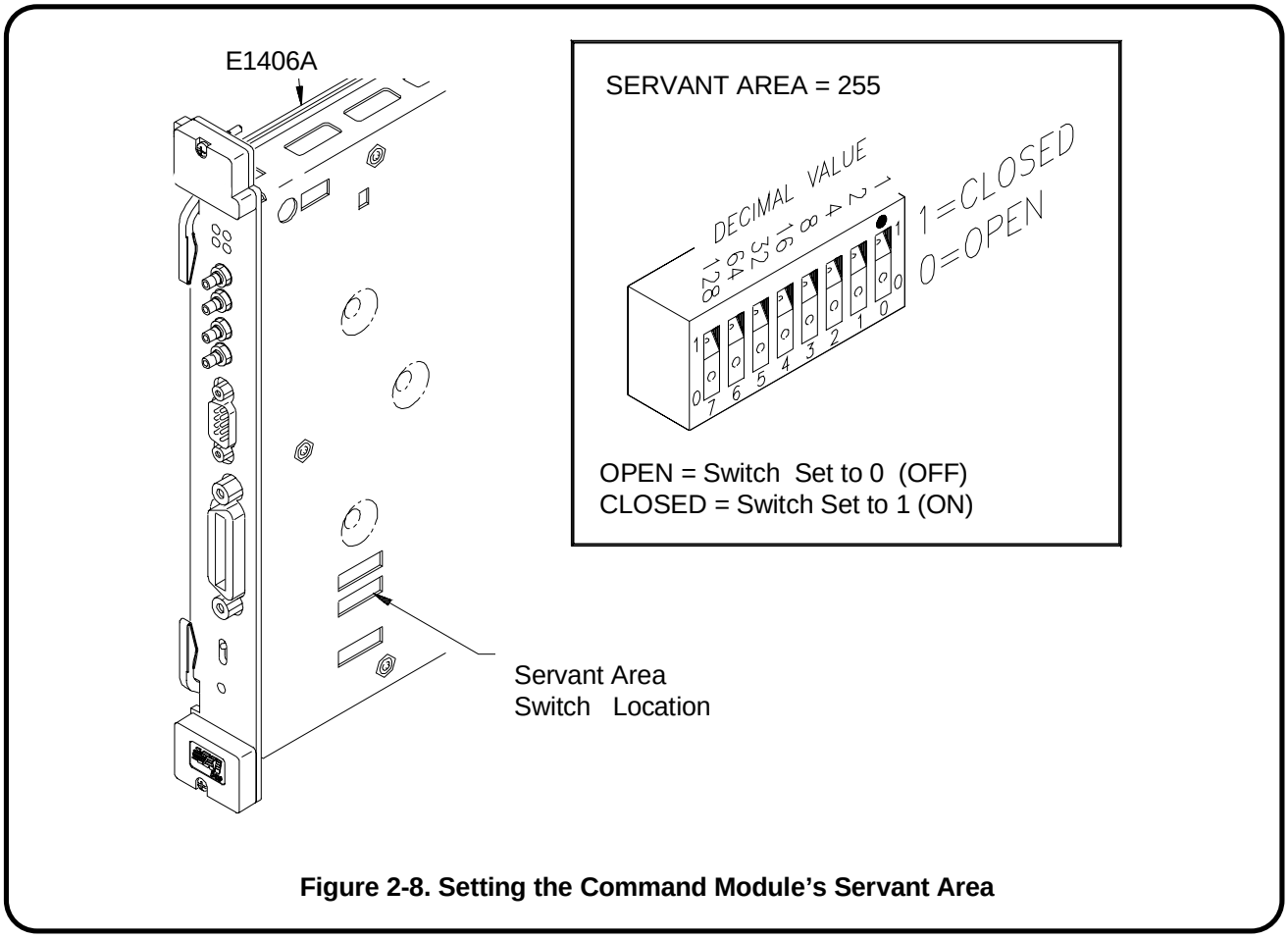


Figure 2-8. Setting the Command Module's Servant Area

In a VXIbus system, modules in the "servant area" of another module are servants to that module (the commander). The commander module controls servant modules by translating Standard Commands for Programmable Instruments (SCPI) commands for register-based modules, or by serving as the GPIB interface to message-based modules. The concept of the servant area and commander/servant hierarchies is discussed more in Appendix A, "Terms and Definitions."

E1406-7 : Set Command Module's Primary GPIB Address

The Command Module has a factory-set GPIB address of 9. If there is only one Command Module (i.e. only one GPIB port) in your VXIbus mainframe, then it is not necessary to change this setting. If there are additional Command Modules in a system connected to the same controller GPIB interface card, each module must have a unique primary GPIB address. (Valid primary GPIB addresses are 0 through 30.)

See Appendix A, "Terms and Definitions," for more information on GPIB (General Purpose Interface Bus).

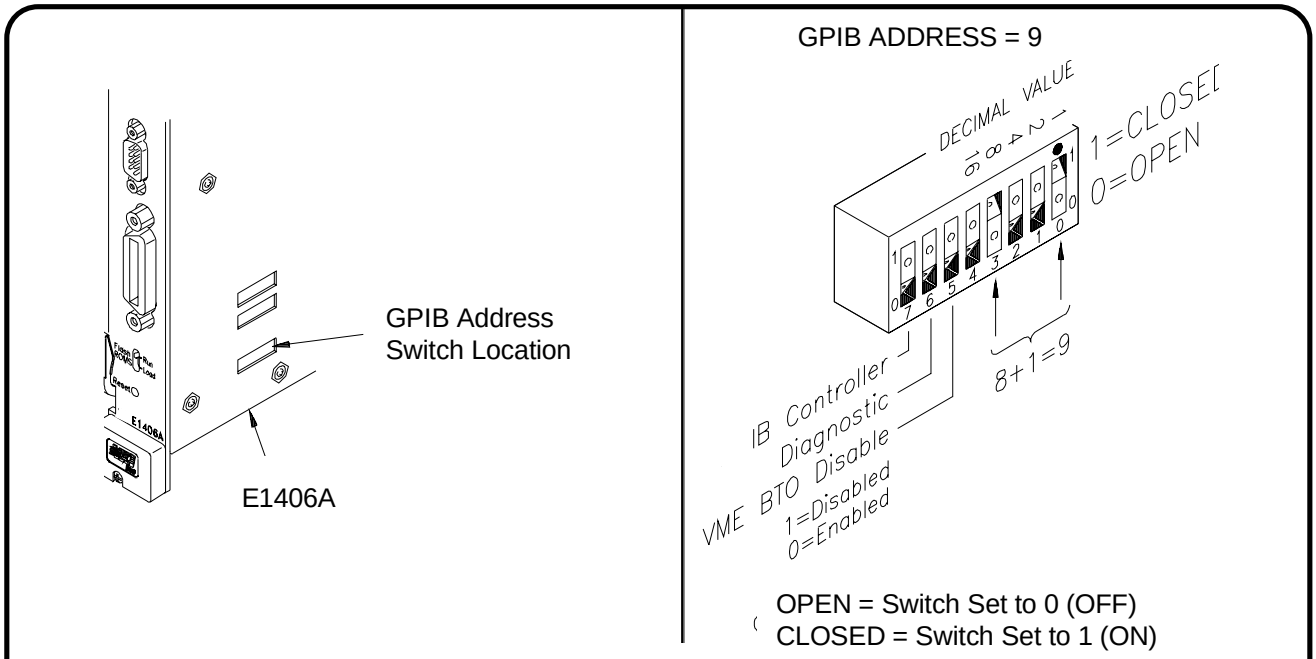


Figure 2- 9. Setting the Primary GPIB Address

"GPIB Controller" switch - '1' sets the Command Module as the GPIB system controller (IBASIC applications) and '0' sets the talk/listen mode. This switch should be set to '1' when IBASIC, rather than an external controller, is to be the system controller.

"Diagnostic" switch - '1' allows the resource manager to start the system instrument but does not start any installed devices. '0' starts the entire system.

"VME BTO Disable" switch - '1' disables the Command Module from functioning as the Data Transfer Bus timer. This function must only be disabled when VXI-MXI mainframe extender modules are part of your VXIbus system.

E1406-8 : Install the Command Module into the Mainframe

Use the following procedure to install the Agilent E1406A Command Module into slot 0.

1. Turn off power on the mainframe by pressing the power button in the lower left corner.
2. If the modules will be installed into a D-Size mainframe, install a support designed for installing C-Size cards in D-Size mainframes.
3. Insert the module into the mainframe by aligning the top and bottom of the card with the card guides inside the mainframe. Slowly push the module straight into the slot until it touches the backplane connectors.
4. Push in the extraction levers to seat the module into the mainframe.
5. Tighten the retaining screws on the top and bottom edges of the front panel.

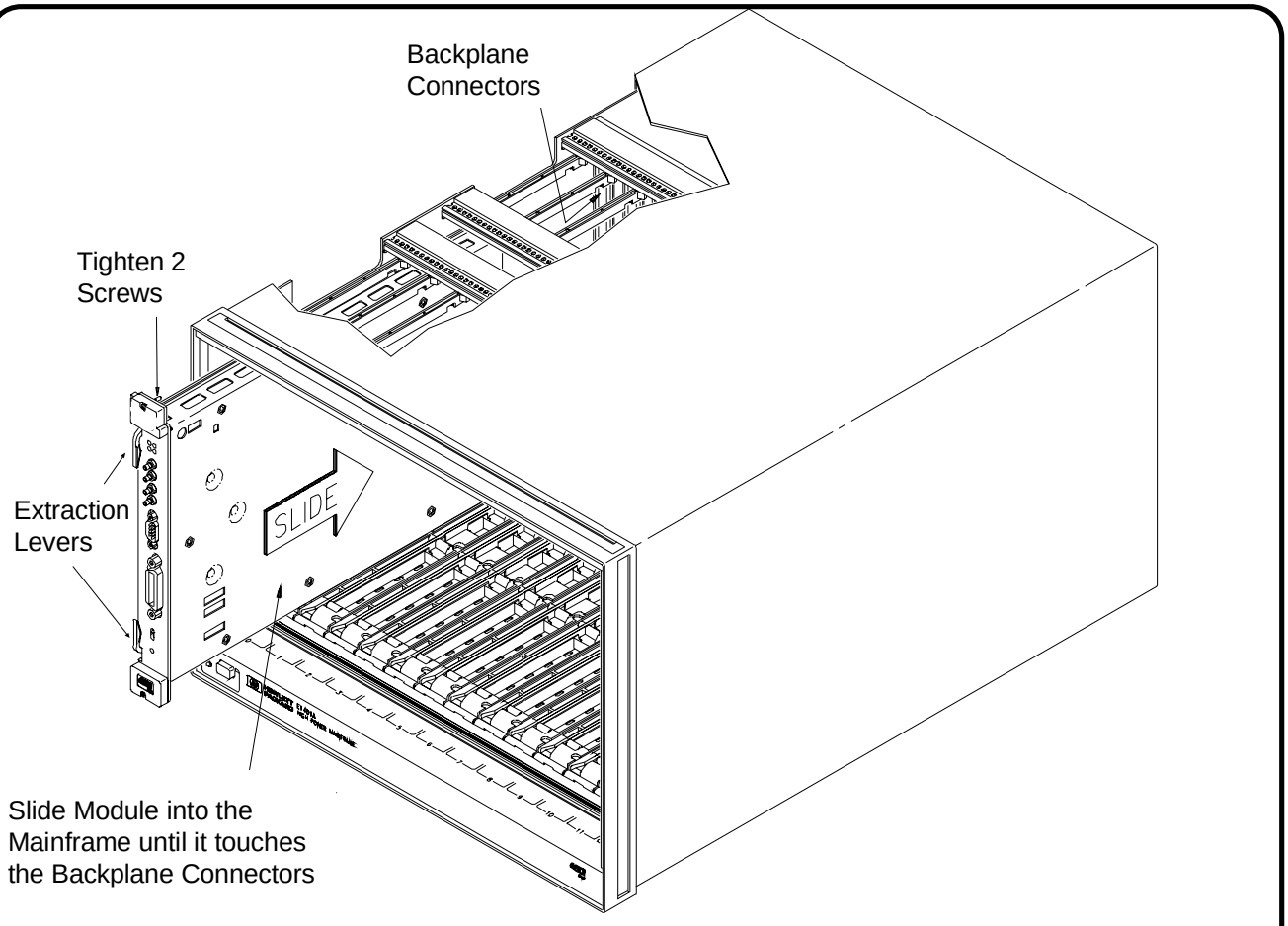


Figure 2-10. Installing Modules

E1406-9 : Connect Interface Cables

NOTE Refer to your controller's documentation for information on connecting the keyboard and video cables and other peripherals.

GPIB Connections

Connect one end of the GPIB Cable to your external computer (PC or Workstation) and the other end to the Agilent E1406A Command Module installed in the Mainframe.

You can also connect a terminal or PC to the Command Module using the RS-232 interface as shown. Such a connection will display the Command Module's power-on and configuration sequence, and function as a front panel to your VXIbus C-Size system.

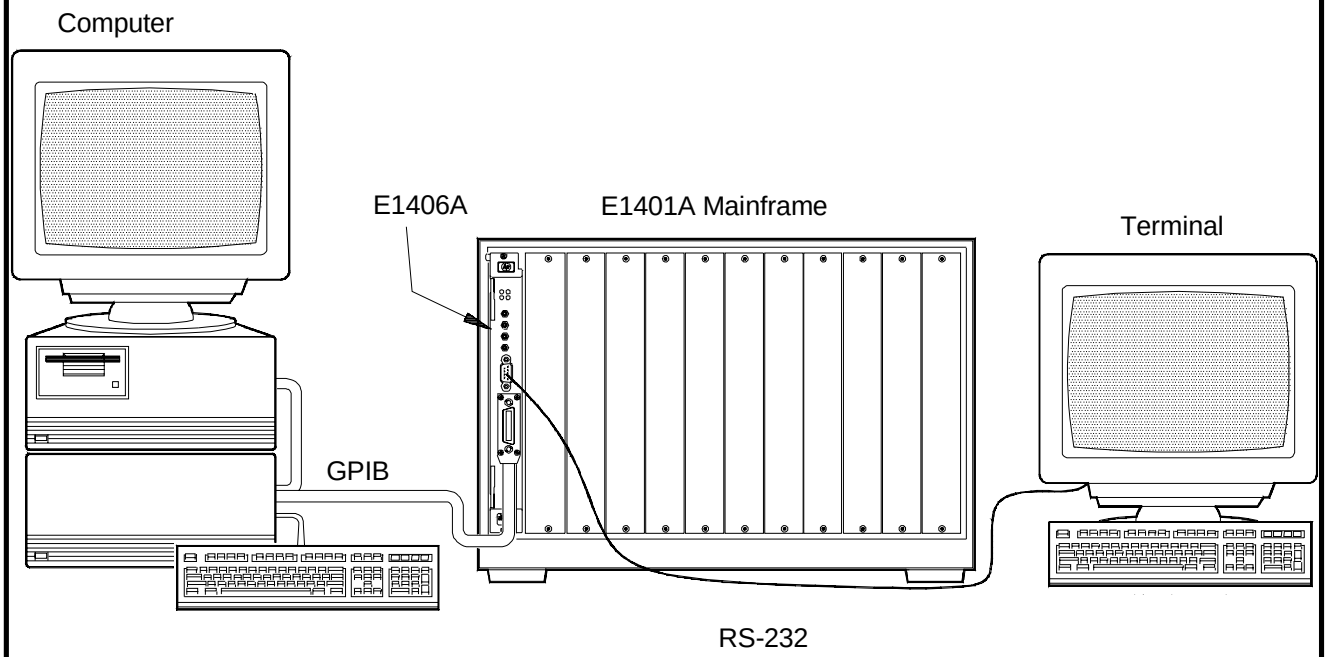


Figure 2-11. Typical GPIB Connections

RS-232 Connections

The Command Module has a 9-pin DTE RS-232 connector. You can connect a terminal or PC to the Command Module using the RS-232 interface as shown in the following figure. Such connections can display the

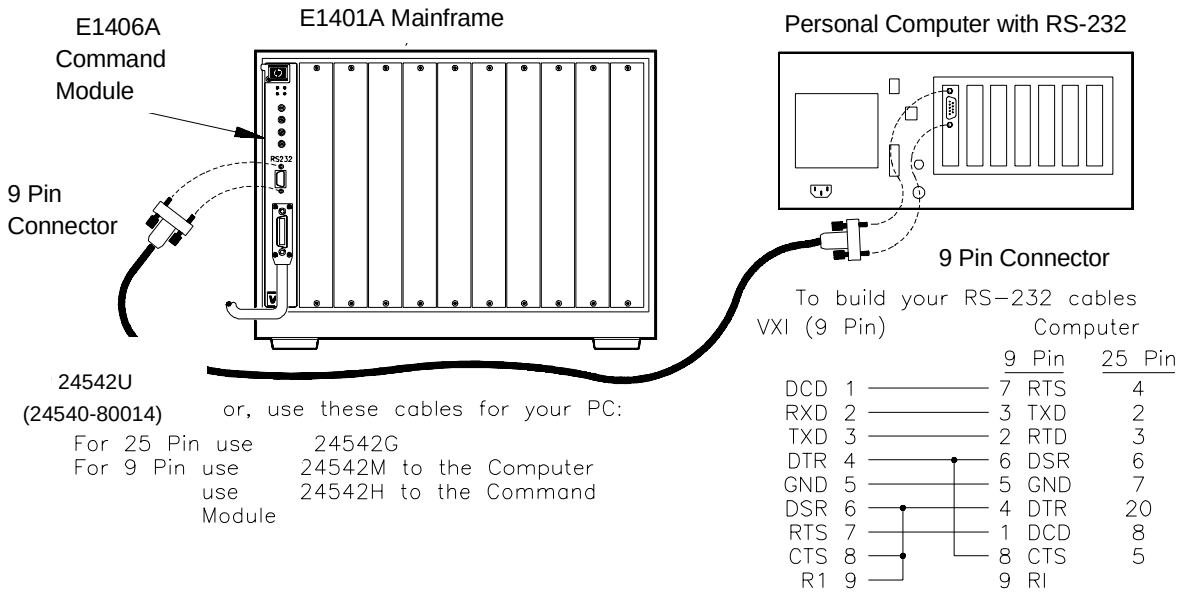


Figure 2-10. Connecting a PC to the Command Module

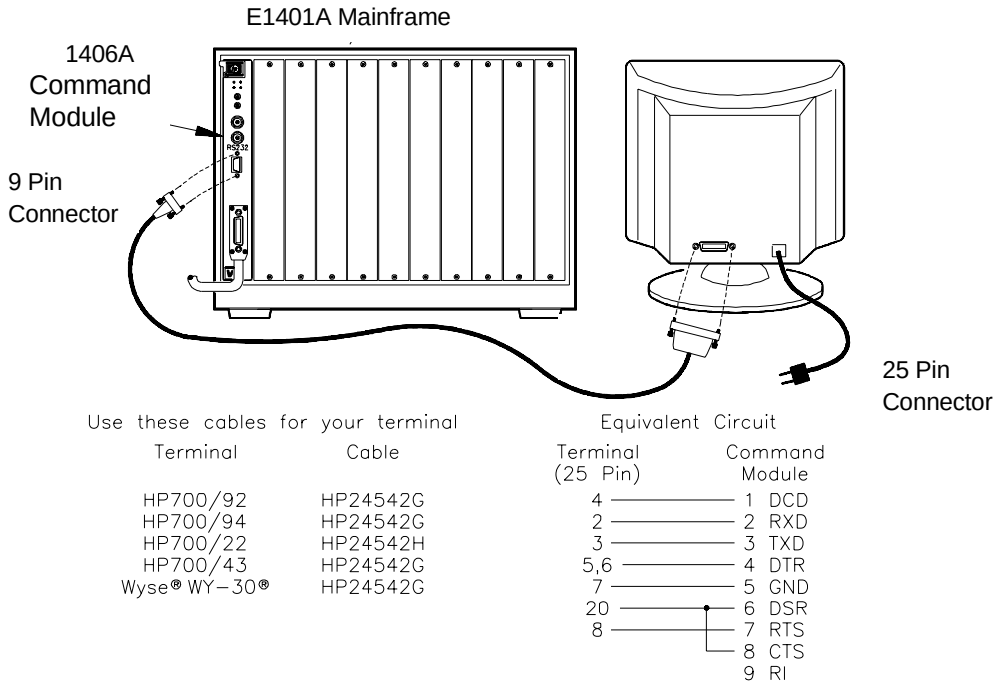


Figure 2-11. Connecting a Display Terminal

Command Module's power-on and configuration sequence, and function as a front panel to your VXIbus C-Size system.

See Appendix A, "Terms and Definitions," for information on the Command Module's RS-232 interface configuration

E1406-10 : Apply Power

Check that the Agilent E1406A **Flash ROMS** switch is in the "Run" position and then turn on the VXI mainframe. An example of the E1406A's power-on and configuration sequence is shown in Figure 2-12. This sequence can be monitored on an RS-232 terminal or printer connected to the Command Module's RS-232 serial interface port (see "RS-232 Connections" on page 2- 12). Pressing CTRL S on the terminal keyboard pauses the sequence. Pressing CTRL Q allows the sequence to resume. Note that once the sequence is paused, it remains paused until CTRL Q is pressed.

NOTE *If a serial terminal or printer is not available, the program in Procedure 6 can be used to check your system.*

Configuration and Start-Up Errors

If the Command Module fails its self test, the "Failed" annunciator lights up on the faceplate. Should this occur:

- turn the mainframe off, remove the Command Module, check the configuration switches (i.e. logical address, slot 0/system controller enable).
- if necessary, call your nearest Agilent Technologies sales and service office.

NOTE *When using the Command Module for the first time or when the mainframe has not been turned on for at least one week, leave the mainframe on for at least 15 hours to fully charge the Command Module's battery.*

If a configuration or start-up error such as an invalid address or failed self test occurs, the error is reported in the power-on and configuration sequence. A list of the configuration and start-up error messages and their causes can be found at the end of this guide.

```
                    Testing ROM
                Testing 512K Bytes RAM
                      Passed
                    Testing CPU
1.              CPU Self Test Passed
                    GPIB address:  09
                    Talk/Listen
        Command Module ladd = 0
        Command Module servant area = 255
        Command Module VME bus timeout -- DISABLED
        Searching for static devices in mainframe 0
              SC device at ladd      0  in slot 0
2       Searching for static devices on interconnect bus 1
        Searching for dynamic devices in mainframe 0
        Searching for pseudo devices
        Configuring Commander / Servant hierarchy
3             ladd = 0, cmdr ladd =    -1
        Validating Commander / Servant hierarchy
        Mapping A24 Memory
4             ladd    0, offset = 00200000H, size = 131072 Bytes
        Mapping A32 memory
        Configuring VME interrupts
              VME interrupt line 1 assigned to ladd   0, handler ID 1
              VME interrupt line 2  - no handler assigned
              VME interrupt line 3 - no handler assigned
5.            VME interrupt line 4 - no handler assigned
              VME interrupt line 5 - no handler assigned
              VME interrupt line 6 - no handler assigned
              VME interrupt line 7 - no handler assigned
        SYSTEM   INSTALLED AT SECONDARY ADDR  0
6.      SYSTEM instrument started
        File System memory: 40131
        File System Started
```

1. The Agilent E1406A operating system performs a series of self-tests and clears its volatile RAM. The Command Module's GPIB address, logical address, servant area, and VME (data transfer) bus timer functionality are reported. You must disable the VME bus timer when Agilent E1482A VXI-MXI mainframe extender modules are part of your system.

2. For each mainframe, the resource manager locates all statically configured modules, locates and configures all dynamically configurable modules, and then locates pseudo devices such as IBASIC. The VXI-MXI extender outward and inward logical address windows are then opened.

3. The resource manager establishes the VXIbus system's commander/servant hierarchies based on the commander's servant area and the servant's logical address. The Command Module in this configuration is the top-level commander, and as such, is not a servant to another commander (cmdr ladd = -1).

4. The resource manager allocates A24 and A32 addresses for those modules' memory requirements. Note that the offset is specified in hexadecimal and the size is specified in bytes. A24 and A32 address space is opened up to modules accessed through the VXI-MXI mainframe extender modules.

5. The resource manager allocates interrupt lines to all interrupt handlers in the system. Agilent register-based modules have their interrupt line jumper set to '1' at the factory. In systems with multiple Command Modules the other interrupt lines are assigned. Modules controlled by those Command Modules must have their jumpers moved accordingly. Interrupt line '1' is enabled to route interrupts OUT from mainframe 137 to the handler in mainframe 0. Interrupt line '1' is enabled to route interrupts IN to the interrupt handler in mainframe 0 (VXIbus extender 2). All other interrupt routing lines are disabled since there are no other interrupt handlers.

6. The resource manager identifies the secondary GPIB addresses in the system, starts the system instrument (i.e. Command Module), issues the Begin Normal Operation (BNO) command to its message based servants and opens GPIB access to those modules.

Figure 2-12. The Agilent E1406A Power-on Sequence

Alternate Command Module Configurations

The procedures in this chapter have described how to configure the Agilent E1406A Command Module as the system's resource manager and slot 0 device. There may be times when you do not need a Command Module configured for these functions. The following sections describe such situations.

Resource Manager Only

If the Command Module is to function *only* as the resource manager and *not* as the slot 0 device (note that dynamic configuration and slot identification will not be done):

1. Set the Command Module's logical address to 0.
2. Set the Slot 0 and System Controller switches to "Disable".
3. Install the Command Module in a slot other than slot 0.
4. Configure another device to provide the system's slot 0 functions.

Slot 0 Only

If the Command Module is to function *only* as the slot 0 device and *not* as the resource manager:

1. Set the Command Module's logical address to a value other than 0.
2. Set the Slot 0 and System Controller switches to "Enable".
3. Set the CLK10 source to "Internal".
4. Install the Command Module in slot 0.
5. Configure another device to perform the resource manager function.

Multiple Command Modules

In systems where there are several Command Modules:

1. Configure one Command Module as the resource manager and slot 0 device as described earlier in this procedure.
2. Set the logical addresses and servant areas of the additional Command Modules based on the logical addresses of their servant modules.
3. Each Command Module must have a unique primary GPIB address if it is connected to the same controller GPIB interface card.
4. Disable the Slot 0 and (VME) System Controller functions on each Command Module not functioning as the resource manager or slot 0 device; there can be only one resource manager and slot 0 device in a system.

5. Only one Command Module is required to translate SCPI commands for the system's Agilent register-based modules - provided the register-based modules are in the Command Module's servant area, they are assigned secondary addresses, and the Command Module contains the instrument drivers.

6. When a Command Module is in the servant area of another Command Module, the Command Module functioning as the resource manager will report one of the following error conditions:

   Error 11: INVALID INSTRUMENT ADDRESS

   3, Config warning, Device driver not found

   Error 11 occurs when the Command Module's logical address is not a multiple of 8. The configuration warning occurs when the logical address is a multiple of 8. In either case, the error or warning can be ignored.

7. Communication and timing between a Command Module and its servants is achieved using VXIbus backplane interrupt lines. The interrupt lines are assigned at power-on by the resource manager. The Command Module resource manager assigns interrupt line 1 to itself. The other interrupt lines are assigned to the system's programmable handlers. Unused interrupt lines are not assigned.

   Agilent's register-based modules are factory-set to interrupt line 1. Thus, for those modules which are servants to a Command Module assigned an interrupt line other than 1, the jumper must be moved to match their Command Module. Refer to the module's documentation for the jumper location. The Command Module resource manager configuration sequence earlier in this procedure shows the interrupt line assigned.

E1406-11 : Where To Go Next

So far you should have done the following:

- Configured your Agilent E1406A Command Module for operation with an external computer (PC or Workstation)
- Installed the Command Module into the Mainframe
- Connected Interface Cables
- Applied Power and verified operation

Once you are done with this procedure, continue with one of the following procedures:

If you have multiple mainframes connected via MXIbus:

- "**Procedure 3: Set Up Your System for Multiple Mainframes**"

If you are using one mainframe:

- "**Procedure 4: Configure and Install Instruments**"

Setting Up a Series 700 Controller

This procedure describes the system configuration and steps necessary for an HP 9000 Series 700 controller to be used as a VXI instrument controller. The steps in this procedure include:

- Series 700-1 : Set Up the Agilent E1482B VXIbus Extender Module
- Series 700-2 : Set Up the Agilent E1406A Command Module
- Series 700-3 : Install the Agilent E1482B Extender Module in the Mainframe
- Series 700-4 : Connect the MXIbus and INTX Cables
- Series 700-5 : Apply Power
- Series 700-6 : Where To Go Next

System Configuration

As shown in Figure 2-13, the HP 9000 Series 700 computer interfaces to the VXI mainframe through the Agilent E1489I MXIbus controller interface card and a Agilent E1482B VXIbus Extender (VXI-MXI) Module installed in mainframe slot 0. The Agilent E1489I requires the Agilent E2093B SICL software. The E1489I and the SICL software provide the system's resource manager functionality. The Agilent E1482B module performs the system's slot 0 functions.

When using a Series 700 controller, communication between the computer and the instruments in the mainframe is through the SICL language or Compiled SCPI (C-SCPI).

Note

This procedure covers configuration of the Agilent E1482B VXIbus Extender Module for use with the Series 700 controller. The procedure assumes the Agilent E1489I MXIbus controller interface card and the Agilent E2093B SICL software are already installed in the Series 700 controller. The following manuals contain installation information on the card and software:

Agilent E1489I MXIbus Controller Interface for HP 9000 Series 700 Workstations "Installation Guide and Overview" (E1489-90000)

"SICL Installation Guide" (E2090-90003)

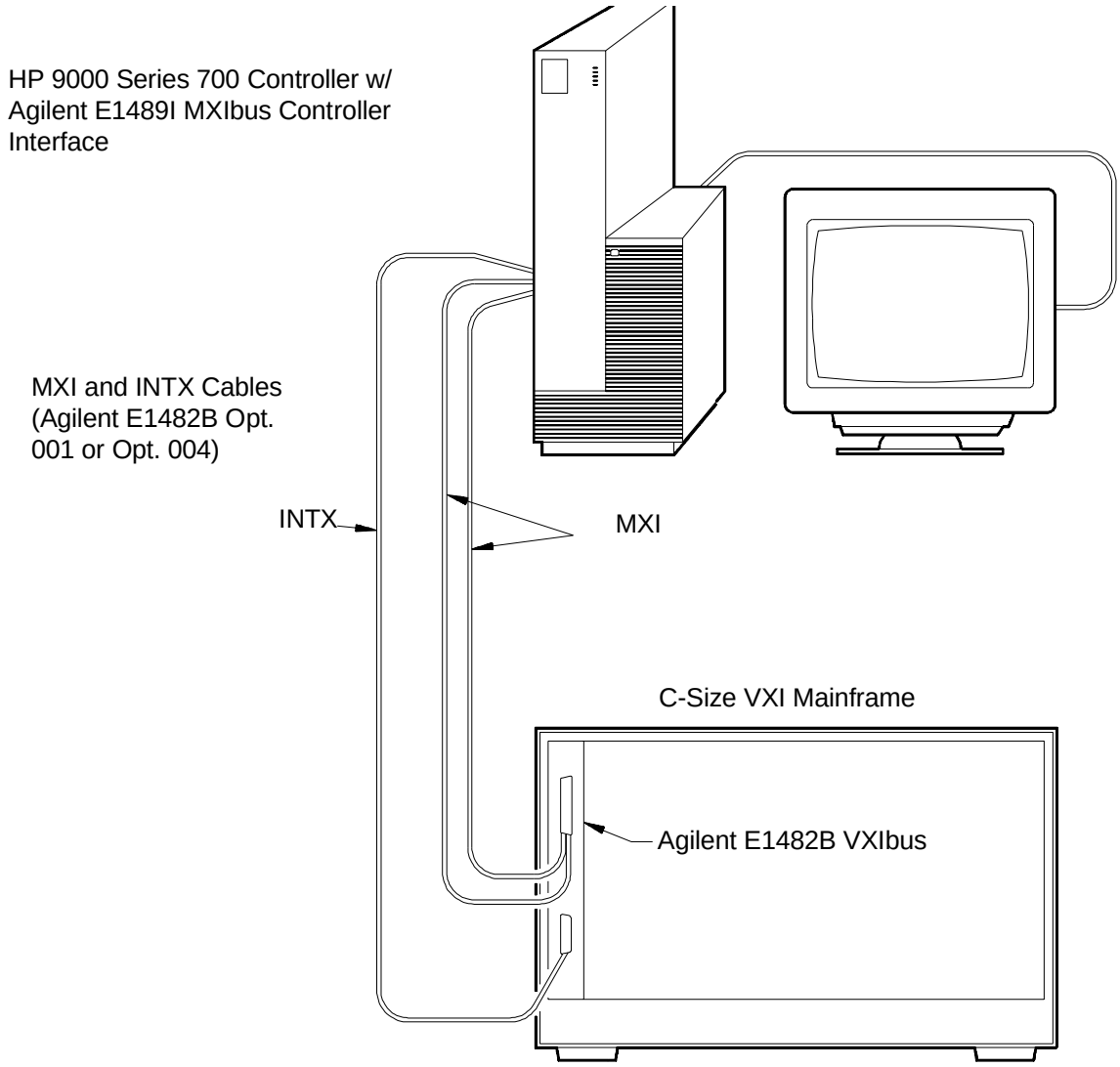


Figure 2-13. VXIbus System with a Series 700 Computer

Series 700-1 : Set up the Agilent E1482B VXIbus Extender Module

The Agilent E1482B VXI-MXI module is factory configured for use in mainframe slot 0. Table 2-1 lists the factory (slot 0) settings. Verify the module settings against Table 2-1 and Figure 2-14.

CAUTION **STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, observe anti-static techniques whenever handling a module.**

Table 2-1. E1482B Slot 0 and Non Slot 0 Configurations

Setting	Switch/ Jumper	Agilent E1482B VXI-MXI Extender Module Slot 0 (factory settings)	Agilent E1482B VXI-MXI Extender Module Non Slot 0
Trigger Input Termination	S5	Trigger 50Ω terminated	
Ext Clk SMB	S6	Output external clock	
MXIbus Terminating Resistor Networks	---	Remove unless last device in daisy chain	Installed
MXI Controller Timeout Level	W8	MXIbus timeout disabled	MXIbus timeout =100 µs
VME BTO Level	W6	VMEbus timeout = 100 µs	VMEbus timeout = 200 µs
INTX Terminating Resistor Networks	---	Remove unless last device in daisy chain	Installed
MXIbus Fairness	S2	Fairness enabled	
Interlocked Arbitration	S3	Interlocked	
MXI System Controller	S4	Not MXIbus controller	MXIbus controller
Logical Address	---	Set the logical address to 1, 2, or 3	Set the logical address to the number above a window boundary (e.g. boundary = 128, logical address = 129)
VXIbus Slot 0 Device	S1, S8	Slot 0	Non-Slot 0
Front Panel Pushbutton	S7	SYSRESET* asserted	
VME BTO Chain Position	W7	1 extender, slot 0	1 extender, non-slot 0
VMEbus Request Level	W1 - W5	Level 3 requester	
CLK10 Source	W9, W10	On-board 10 MHz VXI-MXI installed in slot 0	Do not source CLK10
CLK10 Mapping	W1 - W3	CLK10 mapping disabled	

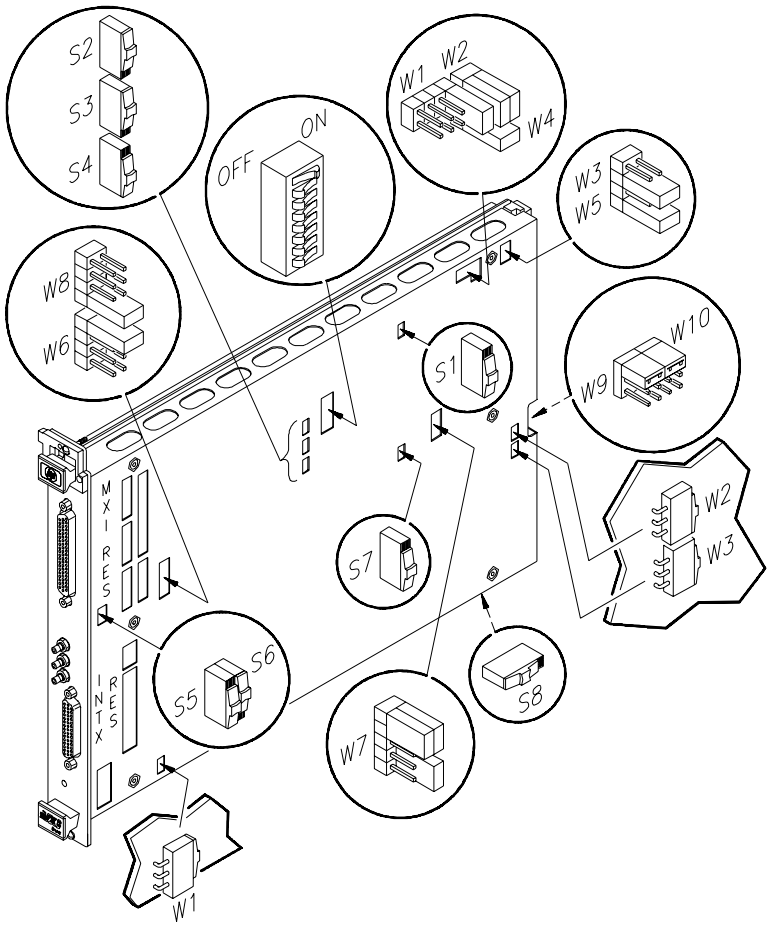


Figure 2-14. E1482B VXI-MXI Extender Slot 0 Configuration

Note *If an Agilent E1406A Command Module is part of your system, continue with step Series 700-2. Otherwise proceed to step Series 700-3.*

Series 700-2 : Set Up the Agilent E1406A Command Module

If an Agilent E1406A Command Module is part of your Series 700/MXI based VXIbus system, you must configure the Command Module for use with the Series 700 computer and the Agilent E1482B VXIbus Extender module. This includes:

- setting the Command Module logical address so that it is a servant to the Series 700
- setting the Command Module servant area so that it is the commander of the system's Agilent Technologies register-based modules
- setting the Command Module primary GPIB address
- disabling the Command Module's slot 0 and system controller capability
- disabling the Command Module's VMEbus Time Out capability

In VXIbus systems with an HP Series 700 computer, Agilent E1482B MXIbus Extender, and a Agilent E1406A Command Module, the following configuration is recommended:

- Series 700 (with the Agilent E1489I MXIbus Controller Interface) is the resource manager
- Agilent E1482B MXIbus Extender is the slot 0 device
- Agilent E1406A Command Module is the commander to the system's Agilent Technologies register-based modules

The resource manager and slot 0 functions and commander/servant hierarchy concepts are covered in Appendix A "Terms and Definitions".

Series 700-2A : Setting the Command Module Logical Address

Notice the following when setting the Command Module logical address.

- The Command Module has a factory-set logical address of 0. Since logical address 0 is the address of the resource manager (the Agilent E1489I card in the Series 700), you must change the Command Module's logical address. Recommended addresses are 1, 2, or 3.

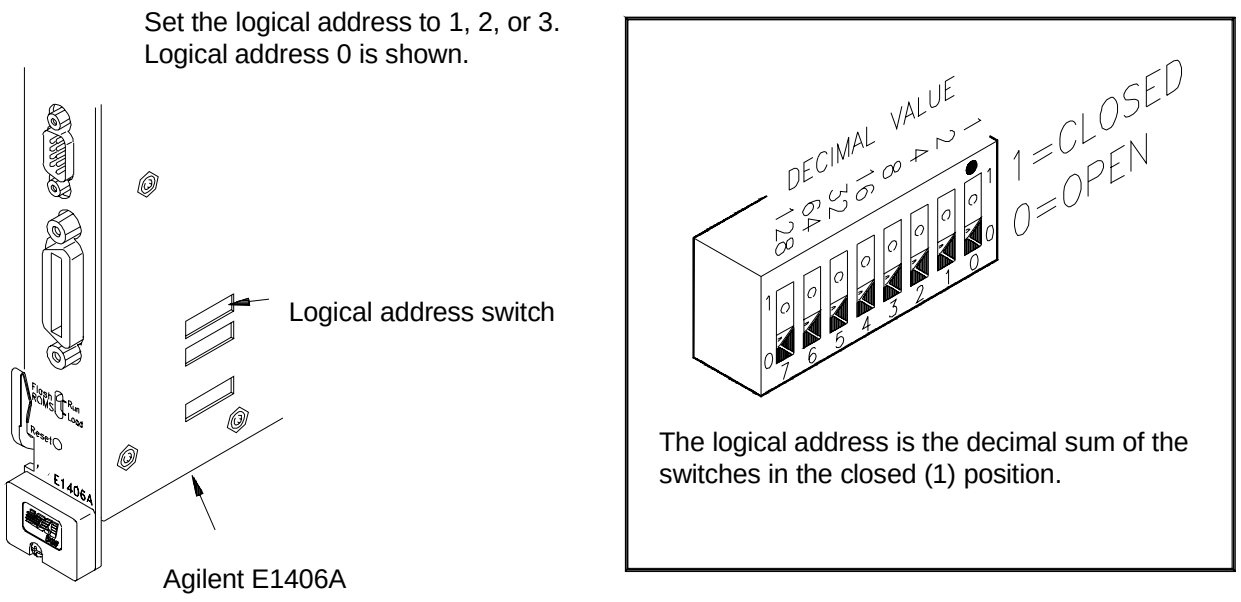

Set the logical address to 1, 2, or 3.
Logical address 0 is shown.
Logical address switch
Agilent E1406A
DECIMAL VALUE
1=CLOSED
0=OPEN
The logical address is the decimal sum of the switches in the closed (1) position.

Figure 2-15. Setting the E1406A Logical Address

Series 700-2B : Setting the Command Module Servant Area

Notice the following when setting the Command Module servant area.

- For the Command Module to be the commander of a register-based module, the register-based module's logical address must fall within the Command Module's servant area. The servant area of the Command Module is determined as:

  Servant area = (**logical address + 1**) through (**logical address** + **servant area switch setting**)

- The logical address plus the Command Module's servant area cannot exceed 255. Therefore, set the servant area based on the logical addresses of the register-based modules in your system.
  For example, if the Command Module's logical address is 1 and its servant area switch is set to 100, the Command Module would be the commander for all modules with logical addresses from 2 through 101.

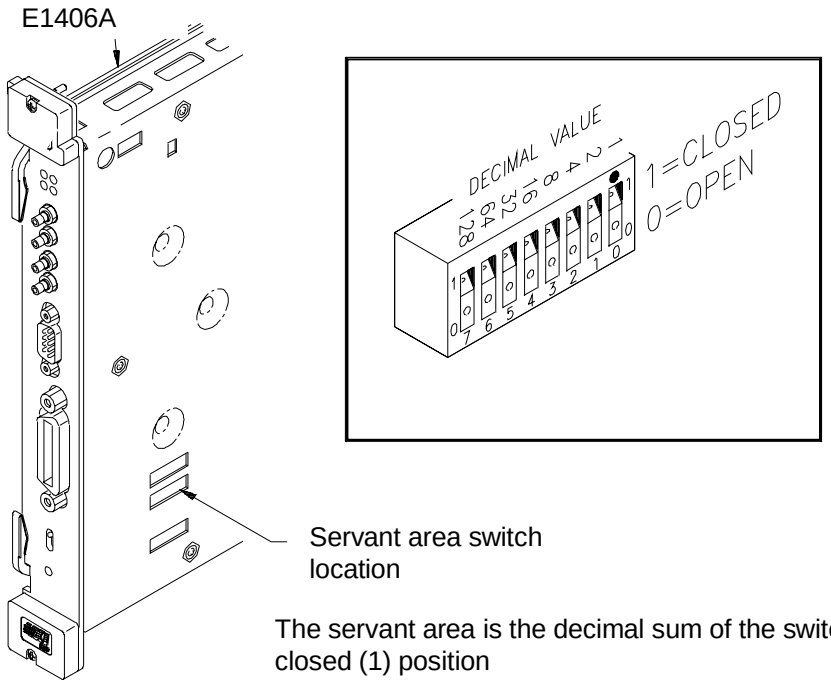

E1406A
DECIMAL VALUE
1=CLOSED
0=OPEN
Servant area switch location
The servant area is the decimal sum of the switches in the closed (1) position

Figure 2-16. Setting the E1406A Servant Area

Series 700-2C : Setting the Command Module Primary GPIB Address

Register-based modules in the servant area of the Command Module are accessed from the Series 700 computer across GPIB and through the Agilent E1406A Command Module. The primary GPIB address identifies the GPIB port on the Command Module. This address is combined with the Command Module's secondary GPIB address (always 00), and with the

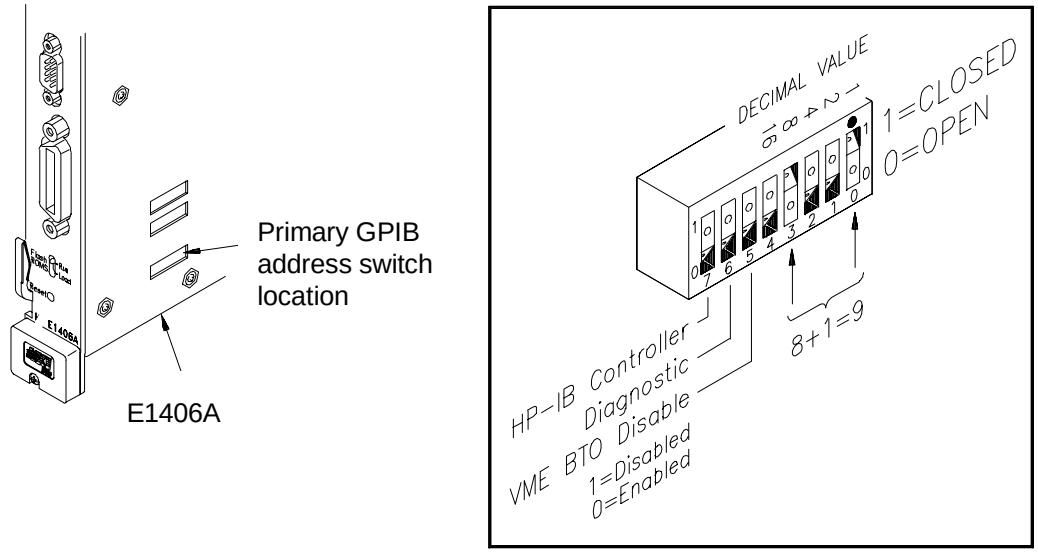


Figure 2-17. Setting the E1406A Primary HP-IB Address

Series 700 computer's (GPIB) interface select code (typically 7), to form the Command Module's complete GPIB address.

Series 700-2D : Disabling the Command Module's Slot 0 Capability

Because the Agilent E1482B VXIbus Extender module is the system's slot 0 module, the slot 0 and VME system controller capability of the Command Module must be disabled. This is done by setting the "System Controller" and "Slot 0" switches to the "Disable" position. The location of these switches is shown in Figure 2-18.

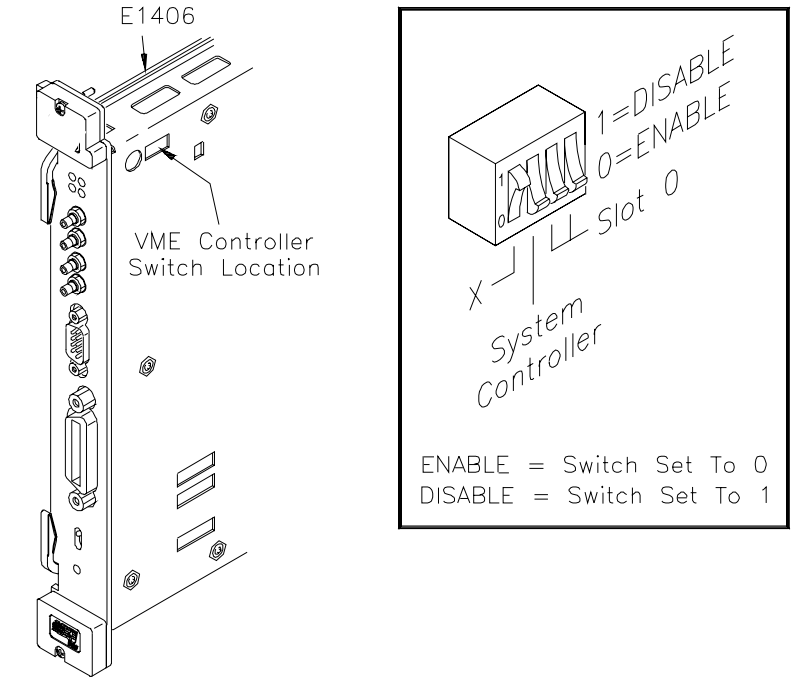
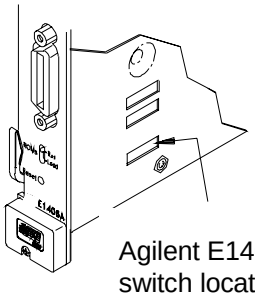


Figure 2-18. Disabling the E1406A Slot 0 Capability

Series 700-2E : Disabling the Command Module's VMEbus Time Out Capability

When E1482 VXIbus Extender modules are part of your system, the modules must function as the Data Transfer Bus (DTB) timer. This means the bus timer capability of the Command Module must be disabled. This is done by setting the 'VME BTO Disable' switch as indicated in Figure 2-19. The VMEbus timer capability (VME BTO Level) of the E1482B is enabled at the factory.



Agilent E1406A
switch location

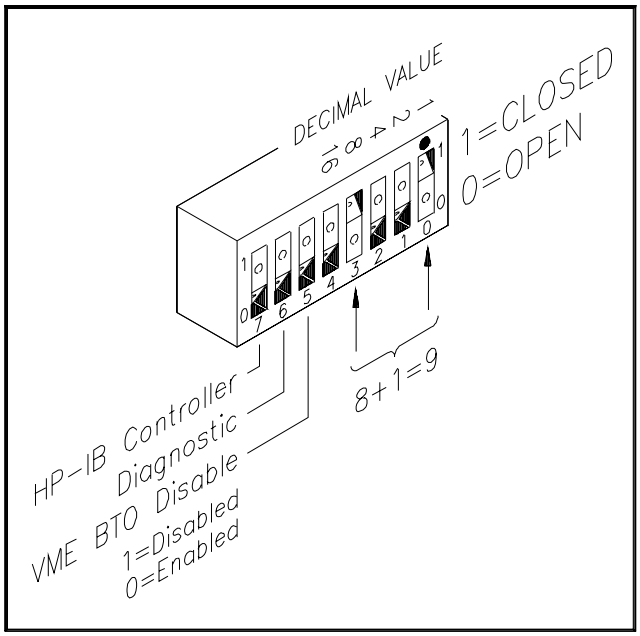


Figure 2-19. Disabling the E1406A VMEbus Time OutCapability

Note *When using the Agilent E1406A Command Module with the HP Series 700 computer, an interrupt line other than line 1 is assigned to the Command Module. In order for the Command Module and the instruments in its servant area to function properly, the devices must use the same interrupt line. Refer to "Assigning Interrupt Lines" in step Series 700-5: "Apply Power" for more information.*

Series 700-3 : Install the Agilent E1482B Extender Module in the Mainframe

Use the following procedure to install the Agilent E1482B VXIbus Extender Module into mainframe slot 0.

1. If the mainframe is on, turn it off.
2. Insert the module into the mainframe by aligning the top and bottom of the VXIbus extender module with the card guides inside the mainframe. Slowly push the module into slot 0 until it seats in the backplane connector.
3. Tighten the retaining screws on the top and bottom edges of the module's front panel.

Installing the E1406A Command Module

Use the following procedure to install the Agilent E1406A Command Module into slot 1 (when the Agilent E1482B module is installed in slot 0).

1. If the mainframe is on, turn it off.
2. Insert the Command Module into the mainframe by aligning the top and bottom of the card with the card guides inside the mainframe. Slowly push the module straight into the slot until it seats in the backplane connectors. The front panel of the module should be even with the front panel of the mainframe.
3. Tighten the retaining screws on the top and bottom edges of the Command Module front panel.

Series 700-4 : Connect the MXIbus and INTX Cables

The MXI and INTX cables are connected between the Series 700 controller and the E1482B extender module as shown in Figure 2-20.

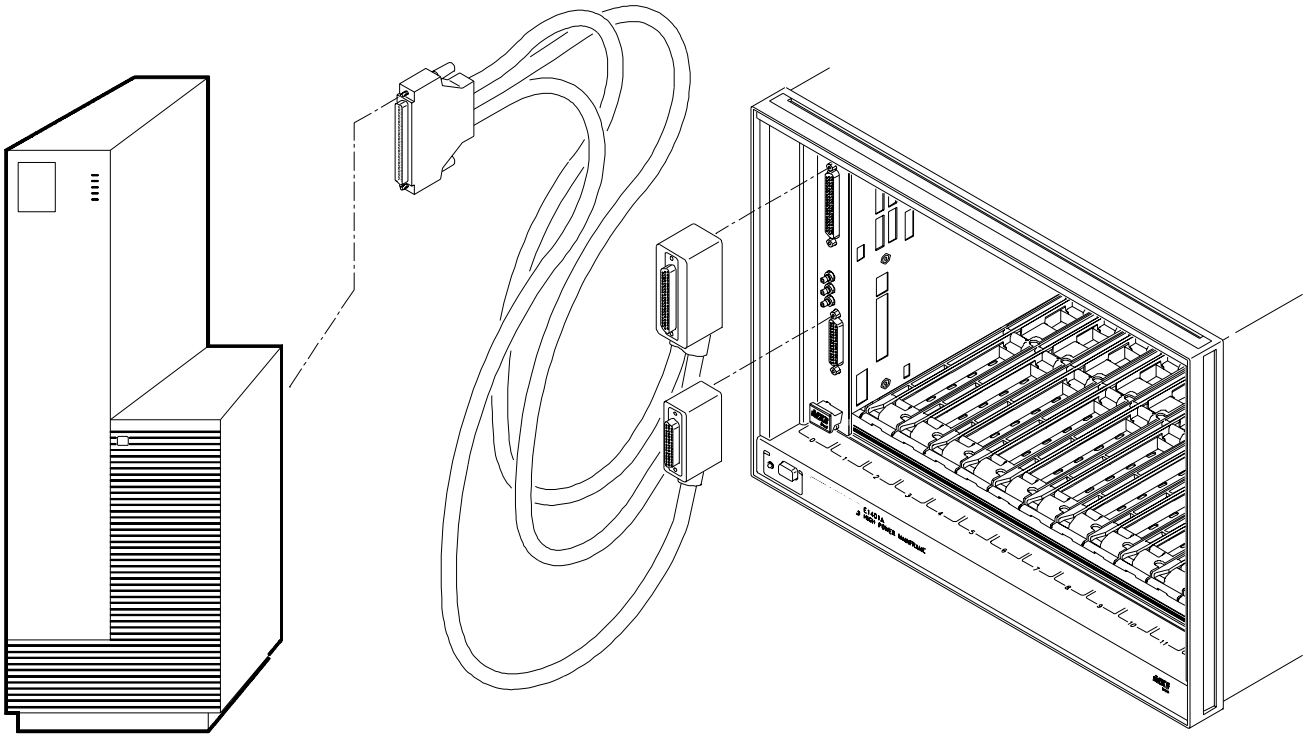


Figure 2-20. Connecting the MXIbus and INTX Cables

Series 700-5 : Apply Power

To verify that the E1482B VXIbus extender module and the MXIbus and INTX cables are correctly installed, turn on the mainframe. This starts the system resource manager function (ivxirm) provided by the Agilent E1489I MXIbus Controller Interface card and the Agilent E2093B SICL software. To view the contents of the configuration file (rsrcmgr.out) written to by the resource manager, type the following command:

```
/usr/pil/bin/ivxisc      (HP-UX)
```

or

```
IVXISC          (from the directory the resource manager executes from)
```

An example of the configuration file (sequence) with only the E1482B installed is shown in Figure 2-21.

```
VXI Current Configuration:
MXI BUS: 0
        Device Logical Addresses: 0  1

VXI Device Table:

Name          LADD  Slot   Bus       Manufacturer          Model
---------     ------ -----  ------    --------------------  ----------
hpmxictlr       0     *       0       Agilent Technologies 0x8fd
hpvximxi        1     *       0       Agilent Technologies 0xfe

* - MXI device

VME Device Table:
Name          Bus    Slot    Space     Size
--------      -----  -----   ---------  ------
No VME cards configured.

Failed Devices:
Name          Bus    Slot    Manufacturer       Model
---------     -----  -----   ----------------------  ----------
No FAILED devices detected.

Protocol Support (Msg Based Devices):
Name          CMDR  SIG  MSTR   INT   FHS  SMP  RG  EG   ERR  PI  PH  TRG  I4  I  LW  ELW  1.3
--------      ---------  ----- ---------  -----  -----  ------  ----  ----  -------  ---  ----  ------ --  --  ---  -----  ----
hpmxictlr       X       X   X                      X      X        X                              X

Commander/Servant Hierarchy:
hpmxictlr
hpvximxi


Memory Map;
A24                          Device Name
-----                        --------------------
0x200000 - 0x2fffffff        hpmxictlr

A32                          Device Name
-----                        --------------------
No devices mapped into A32 space.

Interrupt Request Lines:
                    Handler       Interrupter
Name          1 2 3 4 5 6 7   1 2 3 4 5 6 7
---------     ---------------------------------------
hpmxictlr     X XX X X X X
hpvximxi
```

Figure 2-21. E1489I/E2093B Configuration Sequence

```
VXI-MXI IRQ Routing:

Name          1 2 3 4 5 6 7
--------      - - - - - - -
hpvximxi      I I I I I I I
I - MXI->VXI
O - VXI->MXI
* - Not Routed

VXI-MXI TTL Trigger Routing:

Name          0 1 2 3 4 5 6 7
---------     - - - - - - - -
hpvximxi      I I I I I I I I
I - MXI -> VXI
O - VXI -> MXI
* - Not Routed

VXI-MXI Registers:

Name
--------
hpvximxi
  laddr window register: 0x3f00 range: 0-1
  a24 window register: disabled
  a32 window register: disabled
  Interrupt Configuration Register: 0xffffffff
```

Figure 2-21. E1489I/E2093B Configuration Sequence (Cont'd)

Assigning Interrupt Lines

There are seven backplane interrupt lines. These lines are assigned to devices by the resource manager during the system's power-on sequence. When the HP Series 700/E1489I is the resource manager, it assigns line 1 to itself, and assigns lines 2, 3, 4, ... to other interrupt handlers in the system. In systems containing a Series 700/E1489I (resource manager) and an Agilent E1406A Command Module, the Series 700/E1489I will assign the Command Module interrupt line 2 - if the Command Module has the next lowest logical address.

Agilent Technologies' register-based modules are factory-set to interrupt line 1. This setting is selected on some modules by a finger-moveable jumper; on others the jumper is soldered onto the module. When line 1 is not assigned to the Command Module, you must either assign line 1, or move the jumpers on its register-based servants to the corresponding lines.

An Interrupt line can be assigned to the Command Module by modifying the "irq.cf" file used by the Series resource manager. The location of this file depends on the Series platform shown in the table on the following page.

Platform	Location of file "irq.cf"
HP-UX	/usr/pil/etc/vxi16/irq.cf
BASIC/WS	must be in the directory the resource manager executes from.

As an example, to assign interrupt line 1 to the Command Module:

1. Modify "irq" by adding the line shown in bold. The file listed below is the HP-UX version of "irq.cf".

2. Re-save the file and re-run the resource manager program. Re-run program "ivxisc" (or "IVXISC") and verify that the interrupt line has been assigned.The section "Interrupt Request Lines" in Figure 2-40 will show if the line has been assigned.

```
#
# This database  contains the mapping of VXI devices to Interrupt lines.
# Note that not all VXI devices need to use interrupt lines and that
# not all interrupt lines need to be assigned. However, no interrupt
# line that is allocated in this file can be allocated in the 'vmedevices'
# file.
#
# The format of this files is as follows:
#
# line  handler  interruptors ...
#
# All  fields are <tab> or <space> seperated. All values can be expressed in
# decimal, or hex. The 'line' field is the interrupt line
# being allocated. There can be at most one line for each interrupt
# line. The handler field is the logical address of the interrupt handler
# for this line (not that only one handler can be assigned for any
# given line). The interruptors field is a list of logical addresses of
# interrupters that can use this interrupt line.
#
1  2
```

As shown, interrupt line 1 will be assigned to the Command Module at logical address 2.

Series 700-6 : Where To Go Next

Once you have installed the Agilent E1482 VXIbus extender module, continue with one of the following procedures:

If you have multiple mainframes connected via MXIbus:

- "**Procedure 3: Set Up Your System for Multiple Mainframes**"

If you are using one mainframe:

- "**Procedure 4: Configure and Install Instruments**"

Setting Up an Embedded V743 Controller

This procedure describes the system configuration and steps necessary for an Agilent E1497A V743/64 or Agilent E1498A V743/100 Embedded Controller to be used as a VXI instrument controller. The steps in this procedure include:

- V743-1 : The V743 VXI Configuration
- V743-2 : Set Up the Agilent E1406A Command Module
- V743-3 : Install the V743 Controller in the Mainframe
- V743-4 : Apply Power
- V743-5 : Where To Go Next

V743-1 : The V743 Configuration

As shown in Figure 2-31, the V743 controller requires the following software package:

Agilent E2091C - Standard Instrument Control Library (SICL) HP-UX 9.05 (version C.03.02)

The V743 with the Agilent E2091C software provides the system's resource manager functionality. The V743 also provides the system's slot 0 functions when the controller is installed in mainframe slot 0.

Communication between the V743 controller and the instruments in the mainframe is across the VXIbus backplane, or across GPIB through the Agilent E1406A Command Module.

Note *This procedure lists the V743 VXI configuration and covers installation of the controller into a VXI mainframe. The procedure does not cover installation of the Agilent E2091C software. Refer to the software documentation for software installation information.*

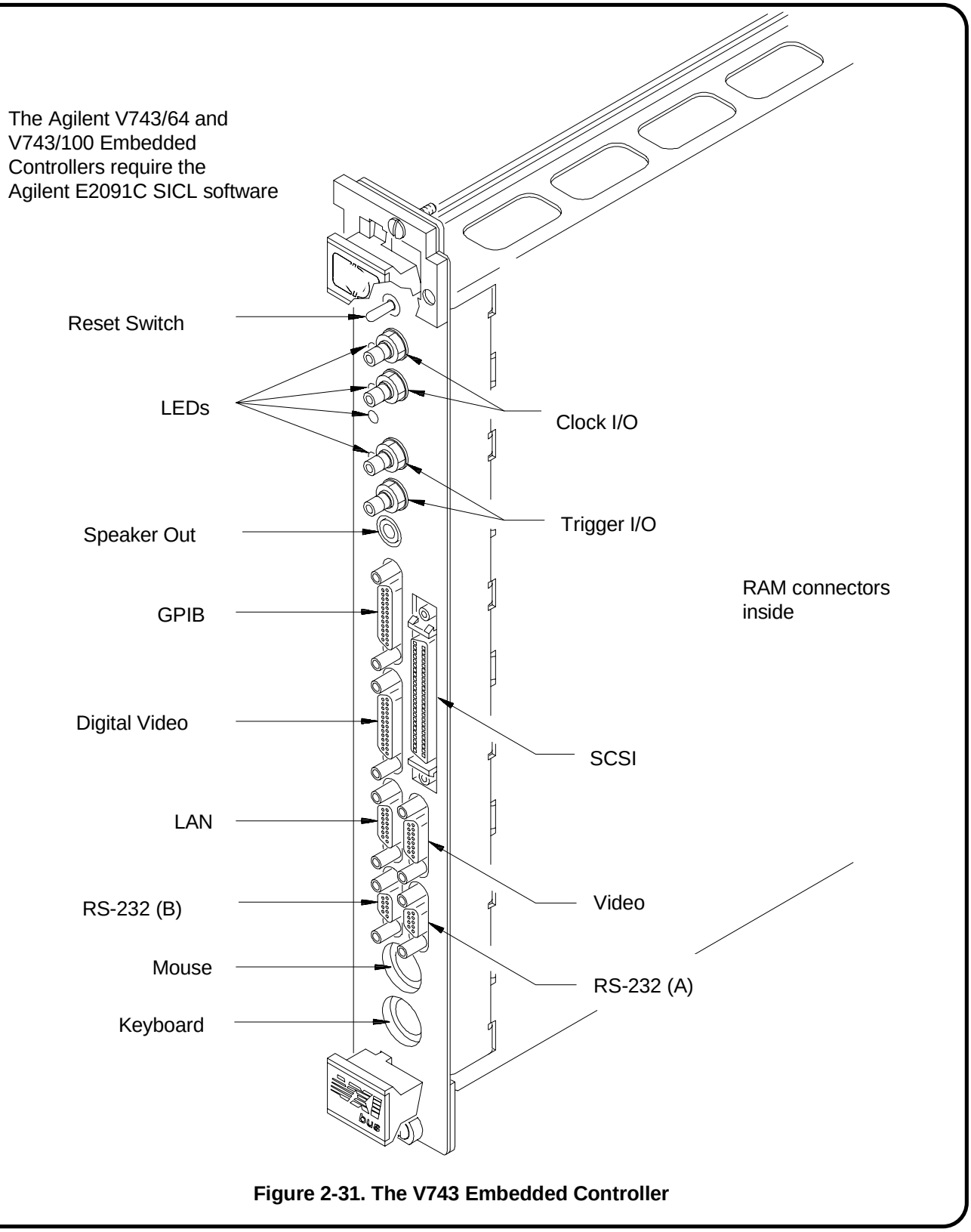


Figure 2-31. The V743 Embedded Controller

The V743 Logical Address and Servant Area

The following pertains to the V743 logical address and servant area:

- The V743 controller has a logical address of 0 and a servant area of 255. These values are stored in software and cannot be changed.
- With a logical address of 0, the V743 is the VXI system's resource manager. It is recommended that the V743 be installed in mainframe slot 0 so that it also functions as the system's slot 0 device.
- With its logical address set at 0 and its servant area set at 255, the V743 controller is the system's top level commander. However, a commander can be a servant to another commander thus forming a hierarchial system. Servants in the servant area of the "lower-level" commander are controlled by the lower-level commander.
- The V743 should be the commander of the system's message-based modules (including other commanders). This enables the message-based modules to be programmed at higher speeds across the VXIbus backplane. A commander such as the Agilent E1406A Command Module should be the commander for the system's Agilent Technologies register-based modules. This enables the register-based modules to be programmed with SCPI commands via the Command Module.

V743-2 : Set Up the Agilent E1406A Command Module

Note *If an Agilent E1406A Command Module is part of your system, continue with Step V743-2. Otherwise, proceed to step V743-3.*

When an embedded controller such as the Agilent E1497A V743/64 or Agilent E1498A V743/100 and a Agilent E1406A Command Module are part of your VXIbus system, you must configure the Command Module for use with the V743. This includes:

- setting the Command Module logical address so that it is a servant to the V743
- setting the Command Module servant area so that it is the commander of the system's Agilent Technologies register-based modules
- setting the Command Module primary GPIB address
- disabling the Command Module's slot 0 and system controller capability

In VXIbus systems with a V743 controller and a Agilent E1406A Command Module, the V743 must function as the resource manager since its logical address is fixed at 0. The V743 should be installed in slot 0 to function as the system's slot 0 device. The E1406A Command Module is then a servant of the V743.

The resource manager and slot 0 functions, and the commander/servant hierarchy concepts are covered in Appendix A "Terms and Definitions".

V743-2A : Setting the Command Module Logical Address

Notice the following when setting the Command Module logical address.

- The V743 controller has a fixed logical address of 0 and a fixed servant area of 255.
- The Command Module has a factory-set logical address of 0. Since logical address 0 is the address of the resource manager (the V743), you must change the Command Module's logical address. Recommended addresses are 1, 2, or 3, which are not instrument identifier addresses (see Procedure 4: Configure and Install Instruments). An address of 1, 2, or 3 also places the Command Module in the servant area of the V743.

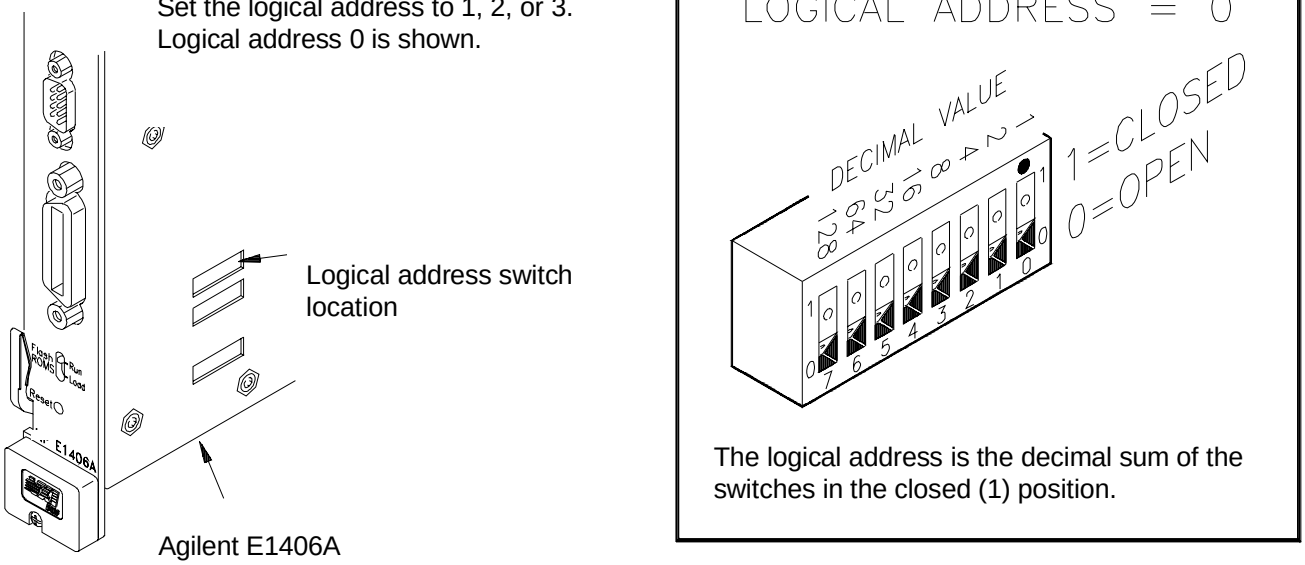

Set the logical address to 1, 2, or 3.
Logical address 0 is shown.
Logical address switch location
Agilent E1406A
LOGICAL ADDRESS = 0
DECIMAL VALUE
1=CLOSED
0=OPEN
The logical address is the decimal sum of the switches in the closed (1) position.

Figure 2-32. Setting the E1406A Logical Address

V743-2B : Setting the Command Module Servant Area

Notice the following when setting the Command Module servant area.

- For the Command Module to be the commander of a register-based module, the register-based module's logical address must fall within the Command Module's servant area. The servant area of the Command Module is determined as:

  Servant area = (**logical address + 1**) through (**logical address** + **servant area switch setting**)

- The logical address plus the Command Module's servant area cannot exceed 255. Therefore, set the servant area based on the logical addresses of the register-based modules in your system.
  For example, if the Command Module's logical address is 1 and its servant area switch is set to 100, the Command Module would be the commander for all modules with logical addresses from 2 through 101.

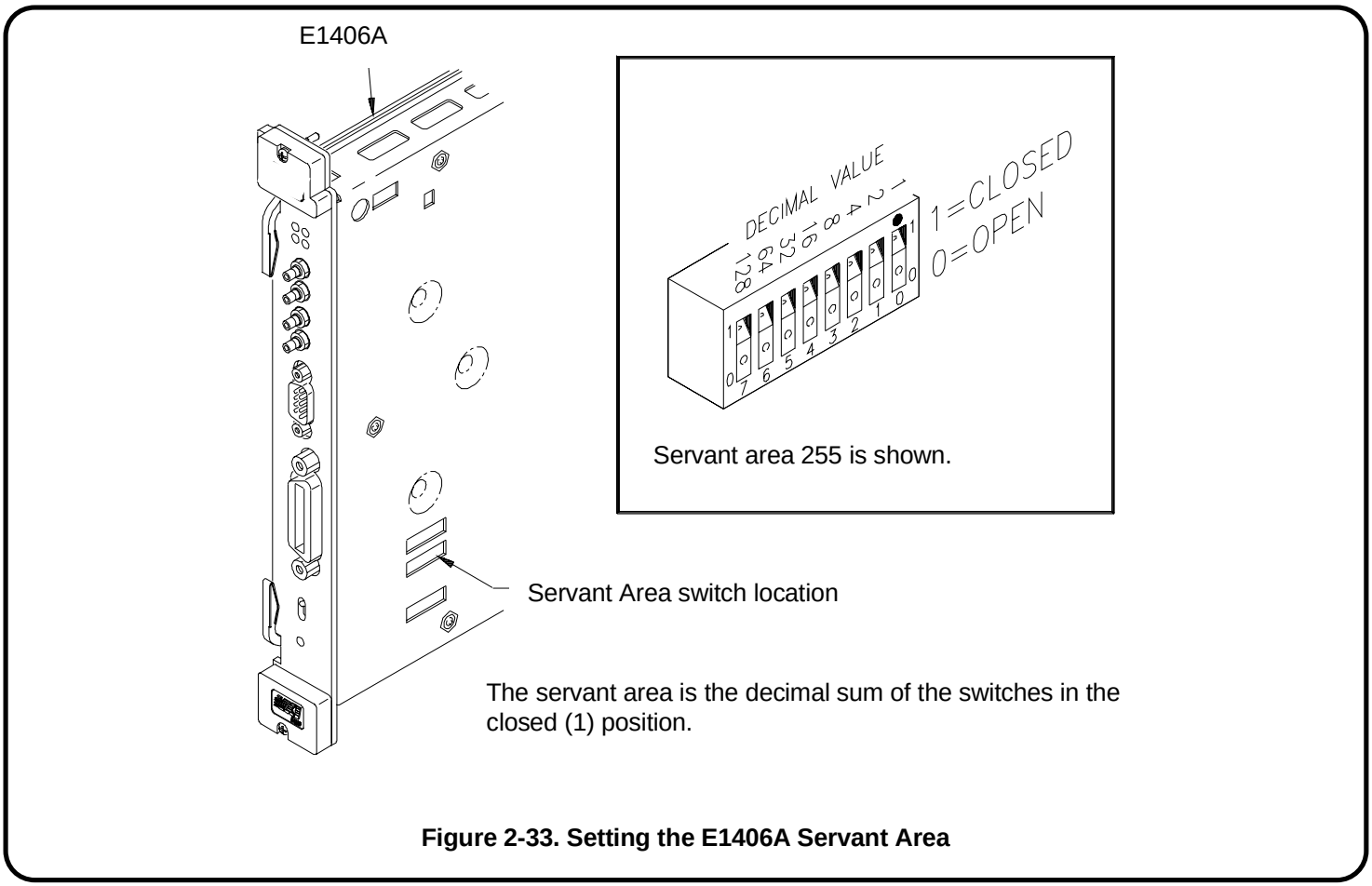

E1406A
DECIMAL VALUE
128 64 32 16 8 4 2 1
1=CLOSED
0=OPEN
Servant area 255 is shown.
Servant Area switch location
The servant area is the decimal sum of the switches in the closed (1) position.

Figure 2-33. Setting the E1406A Servant Area

V743-2C : Setting the Command Module Primary GPIB Address

Register-based modules in the servant area of the Command Module are accessed from the V743 across GPIB and through the Agilent E1406A Command Module. The primary GPIB address identifies the GPIB port on the Command Module. This address is combined with the Command Module's secondary GPIB address (always 00), and with the V743 controller's (GPIB) interface select code (typically 7), to form the Command Module's complete GPIB address.

The location of the primary GPIB address switch is shown in Figure 2-34.

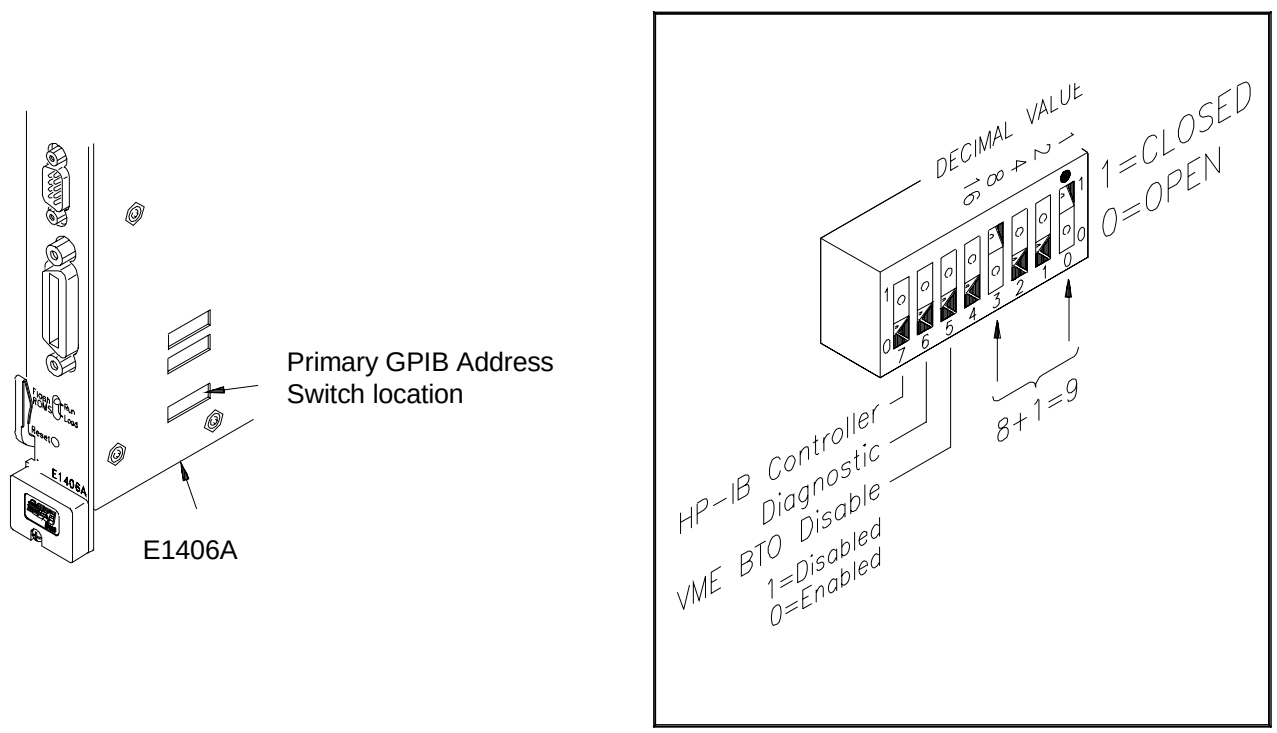


Figure 2-34. Setting the E1406A Primary GPIB Address

V743-2D : Disabling the Command Module's Slot 0 Capability

Because the V743 controller contains the resource manager and slot 0 functionality that is also provided by the Command Module, the slot 0 and VME system controller capability of the Command Module must be disabled. This is done by setting the "System Controller" and "Slot 0" switches to the "Disable" position. The location of these switches is shown in Figure 2-35.

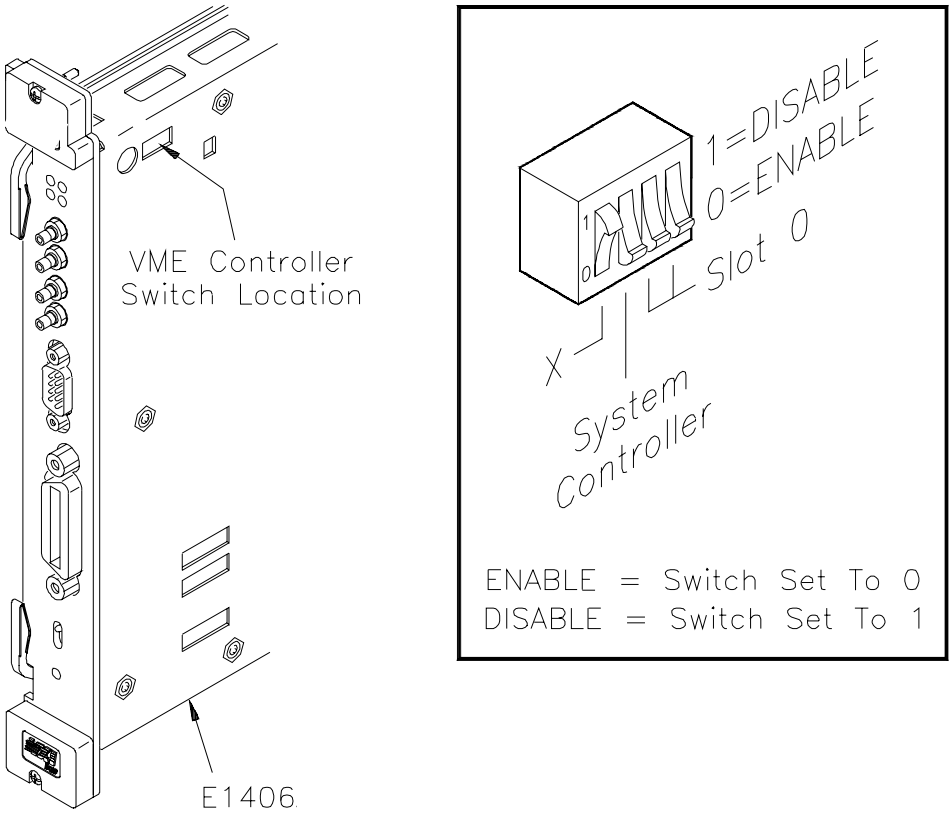


Figure 2-35. Disabling the E1406A Slot 0 Capability

Note

When using the Agilent E1406A Command Module with the V743 controller, an interrupt line other than line 1 is assigned to the Command Module. In order for the Command Module and the instruments in its servant area to function properly, the devices must use the same interrupt line. Refer to "Assigning Interrupt Lines" in step "V743-4B: Apply Power" for more information.

V743-3 : Install the V743 Controller in the Mainframe

Use the following procedure to install the V743 controller into mainframe slot 0.

1. If the mainframe is on, turn it off.
2. Insert the V743 into the mainframe by aligning the top and bottom of the controller with the card guides inside the mainframe. Slowly push the V743 into slot 0 until it seats in the backplane connectors.
3. Tighten the retaining screws on the top and bottom of the controller's front panel.

Note *If your system contains an Agilent E1406A Command Module, continue through step V743-3. Otherwise, continue with step V743-4.*

Note *For information on connecting the monitor, keyboard, mouse, and external peripherals, refer to the "Model V743 VXI Controller Installation Guide". Step V743-4 of this procedure assumes that a keyboard and monitor have been connected.*

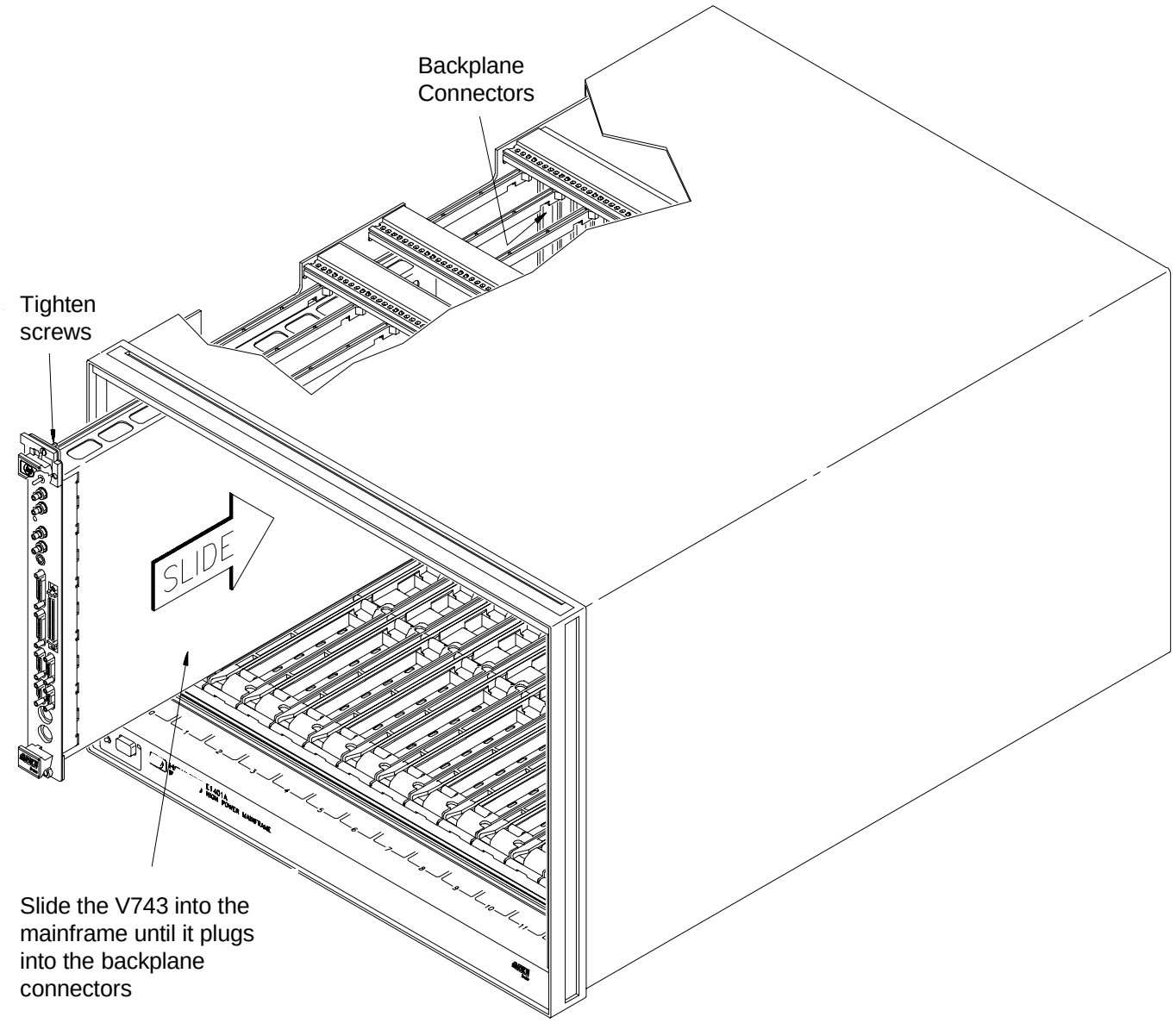


Figure 2-36. Installing the V743 Embedded Controller

Installing the E1406A Command Module

Use the following procedure to install the Agilent E1406A Command Module into slot 1 (when the V743 controller is installed in slot 0).

1. If the mainframe is on, turn it off.
2. Insert the Command Module into the mainframe by aligning the top and bottom of the card with the card guides inside the mainframe. Slowly push the module straight into the slot until it touches the backplane connectors.
3. Push in the extraction levers to seat the module into the mainframe.
4. Tighten the retaining screws on the top and bottom edges of the Command Module front panel.

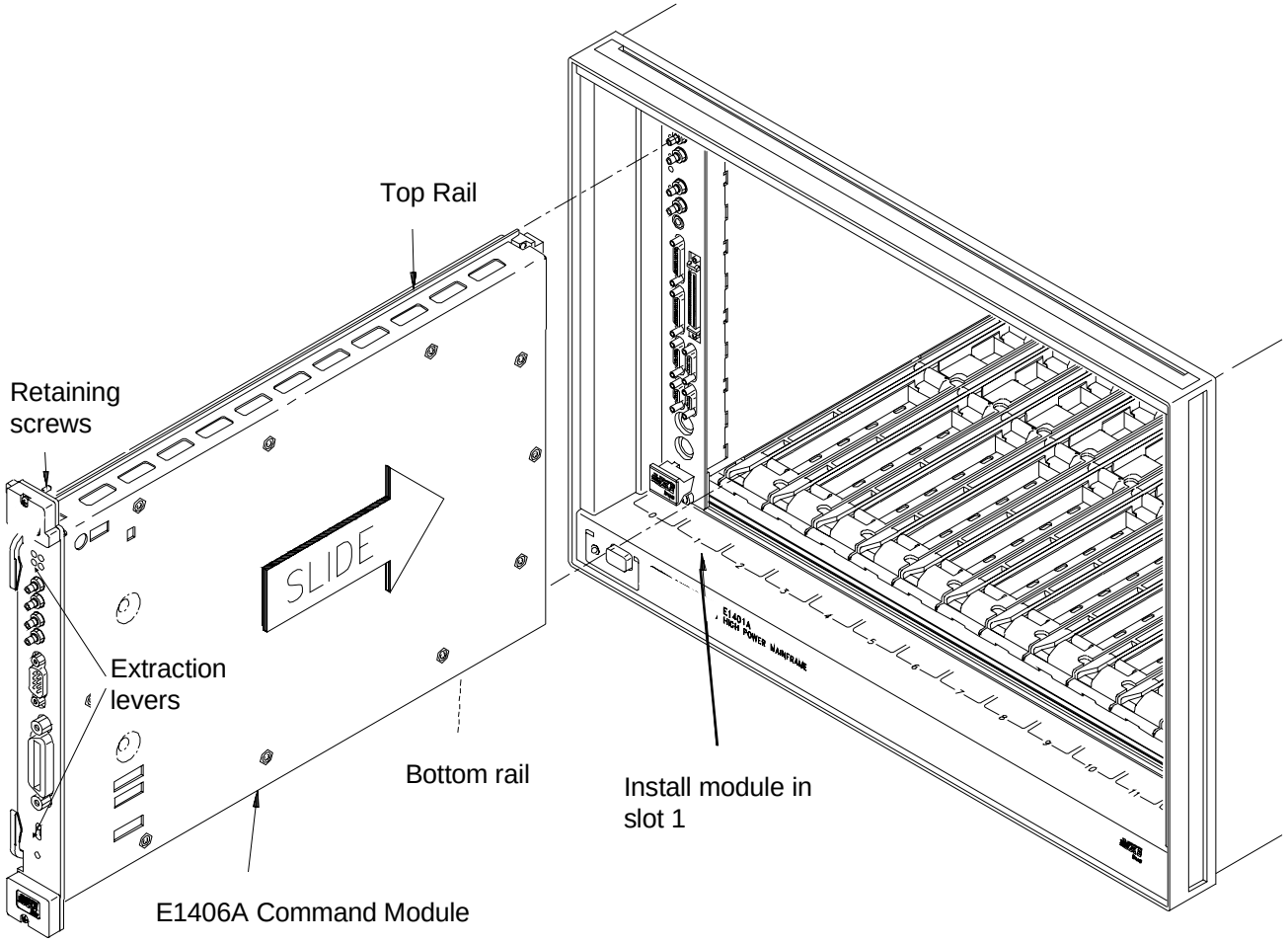


Figure 2-37. Installing the E1406A with the V743

V743-4 : Apply Power

To verify that the V743 controller and software are correctly installed, turn on the mainframe. If the SICL software is installed, the system resource manager (ivxirm) function begins. To view the contents of the configuration file (/usr/pil/etc/vxiLU/rsrcmgr.out) written to by ivxirm, type the following command:

```
ivxisc /usr/pil/etc/vxiLU
```

Where LU is the logical unit number of the VXI interface. An example of the V743 configuration sequence is shown in Figure 2-38.

Note *The information in this step assumes the HP-UX VXI configuration utilities referred to are in the /usr/pil/bin/ directory, and that your system includes a path to that directory. Refer to the Agilent SICL Installation and User's Guide for more information.*

```
VXI Current Configuration:

VXI BUS: 0
        Device Logical Addresses: 0 24  127     128
Slots:                  0   1   2   3   4   5   6   7   8   9   10  11  12
                        --  --  --  --  --  --  --  --  --  --  --  --  --
Empty                       O   O   O   O   O       O   O       O   O
Single Device           X                                   X
Multiple Devices                            X
VME                                                                 V
Failed

VXI Device Table:

Name          LADD  Slot   Bus      Manufacturer          Model
---------     ----- ------ ------   --------------------  ----------
v743ctlr        0     0       0     Agilent Technologies  E1497 Series 700 VXI Controller
dmm            24     9       0     Agilent Technologies  E1410 DMM
translator     127    6       0     Agilent Technologies  E1404 Translator Module
msgtrans       128    6       0     Agilent Technologies  E1404 Translator Message Interface

VME Device Table:

Name          Bus    Slot    Space     Size
--------      -----  -----   ---------  ------
memdev          0     12      A24      512K

Failed Devices:

Name          Bus    Slot    Manufacturer          Model
---------     -----  -----   --------------------  ----------
No FAILED devices detected.
```

Figure 2-38. V743 Configuration Sequence

```
Protocol Support (Msg Based Devices):
Name          CMDR  SIG  MSTR  INT  FHS  SMP  RG  EG  ERR  PI  PH  TRG  I4  I  LW  ELW  1.3
--------      ----------  -----  ---------  -----  -----  ------  ----  ----  ------  ---  ----  ------  --  --  ---  -----  ----
v743ctlr        X       X   X                    X         X       X                          X
dmm                             X                   X    X X                 X   X X            X
msgtrans                X   X X                 X    X X    X  X    X                 X

Commander/Servant Hierarchy:
v743ctlr
        dmm
        translator
        msgtrans

Memory Map:
A24                     Device Name
-----                   --------------------
0x200000 - 0x27ffff     memdev
0x300000 - 0x3fffff         v743ctrl

A32                     Device Name
-----                   --------------------
No devices mapped into A32 space.

Interrupt Request Lines:

                  Handler               Interrupter
Name      1 2 3 4 5 6 7         1 2 3 4 5 6 7
- - - -      - - - - - - -         - - - - - - -
V743ctrl  X    X X X X X
dmm
translator
msgtrans    X                   X
```

Figure 2-38. V743 Configuration Sequence (Cont'd)

V743-4A : Enabling Shared Memory

Enabling and disabling the V743 shared memory is software controlled. The V743 ships with its shared memory disabled. You can enable the shared memory (1 Mbyte) by typing:

```
/usr/pil/bin/e1497cnf -i vxi
```

The utility will prompt with the following:

will need to reboot system, is this ok? y

e1497 shared memory is currently disabled, would you like to enable shared memory? (y or n) (y enable, n disable)

The V743 shared memory is mapped into VXI A24 address space. Thus, the memory is accessible from the V743 and from other devices such as the Agilent E1406A Command Module. Notice that the V743 accesses the memory as SHARED, and not from the A24 memory map (Figure 2-38).

V743-4B : Assigning Interrupt Lines

There are seven VME backplane interrupt lines. These lines are assigned to devices by the resource manager during the system's power-on or reset sequence. When the V743 controller is the resource manager, it assigns line 1 to itself, and assigns lines 2 through 7 to other interrupt handlers in the system. In systems containing a V743 controller (resource manager) and an Agilent E1406A Command Module, the V743 will, by default, assign the Command Module interrupt line 2 - if the Command Module has the next lowest logical address.

Agilent Technologies' register-based modules are factory-set to interrupt line 1. This setting is selected on some modules by a finger-moveable jumper; on others the jumper is soldered onto the module. When line 1 is not assigned to the Command Module, you must either assign line 1, or move the jumpers on its register-based servants to the corresponding lines.

An interrupt line can be assigned to the Command Module by modifying the /usr/pil/etc/vxiLU/irq.cf configuration file. The location of this file depends on the SICL logical unit number assigned to the VXI interface (default = 24). For example:

SICL Logical Unit	Location of file "irq.cf"
24	/usr/pil/etc/vxi24/irq.cf

Example - Assigning an Interrupt Line

As an example, to assign interrupt line 1 to the Command Module at logical address 2:

1. Modify irq.cf by adding the line shown in **bold** on the next page.

2. Re-save the file and re-run the resource manager utility ivxirm. Run ivxisc /usr/pil/etc/vxi24 and verify that the interrupt line has been assigned.(The "Interrupt Request Lines" section of the configuration sequence will show if the line has been assigned.)

```
#
# This database  contains the mapping of VXI devices to Interrupt lines.
# Note that not all VXI devices need to use interrupt lines and that
# not all interrupt lines need to be assigned. However, no interrupt
# line that is allocated in this file can be allocated in the 'vmedevices'
# file.
#
# The format of this files is as follows:
#
# line  handler  interruptors ...
#
# All  fields are <tab> or <space> seperated. All values can be #expressed in
# decimal, or hex. The 'line' field is the interrupt line
# being allocated. There can be at most one line for each interrupt
# line. The handler field is the logical address of the interrupt handler
# for this line (not that only one handler can be assigned for any
# given line). The interruptors field is a list of logical addresses of
# interrupters that can use this interrupt line.
#
1  2
```

As shown, interrupt line 1 will be assigned to the Command Module at logical address 2.

V743-5 : Where To Go Next

Once you have installed the V743 controller, continue with one of the following procedures:

If you have multiple mainframes connected via MXIbus:

- "**Procedure 3: Set Up Your System for Multiple Mainframes**"

If you are using one mainframe:

- "**Procedure 4: Configure and Install Instruments**"

Setting Up an Embedded RADI-EPC7 486 Computer

This procedure explains how to set up and install an Agilent 75000 Series C VXIbus system equipped with an Embedded Agilent RADI-EPC7 Computer. The steps in this procedure consists of the following:

- EPC7-1 : Set the EPC7 as Slot 0 Device
- EPC7-1A : Set the EPC7 as Non-Slot 0 Device if Using Multiple Mainframes
- EPC7-2 : Install the EPC7 into the Mainframe
- EPC7-3 : Install EXM Expansion Modules
- EPC7-4 : Configure the Command Module to Work With the EPC7
- EPC7-5 : Connect Interface Cables
- EPC7-6 : Apply Power
- EPC7-7 : Where To Go Next

The embedded Agilent RADI-EPC7 computer is shipped from the factory with software already installed. EPConnect is a set of system development tools that can be used on the VXIbus system containing one or more Agilent RADI-EPC modules. One of the tools is the Start-Up Resource Manager (SURM). The SURM performs the required functions of the resource manager.

If you need information on terms used in this manual, see Appendix A, "Terms and Definitions."

CAUTION **STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, observe anti-static techniques whenever handling a module.**

NOTE *The EPC7 contains a hard disk. Please handle it with care. Avoid jarring the unit while it is in operation, and do not use excessive force when inserting or removing the EPC7 in a VXIbus mainframe.*

EPC7-1 : Set the EPC7 as Slot 0 Device

The Agilent RADI-EPC7 is shipped from the factory to be the VXI Slot 0 Controller and System Controller. Therefore, if you are using the EPC7 as the slot 0 controller, you do not have to change any switches or jumpers. This figure illustrates the jumper positions and definitions.

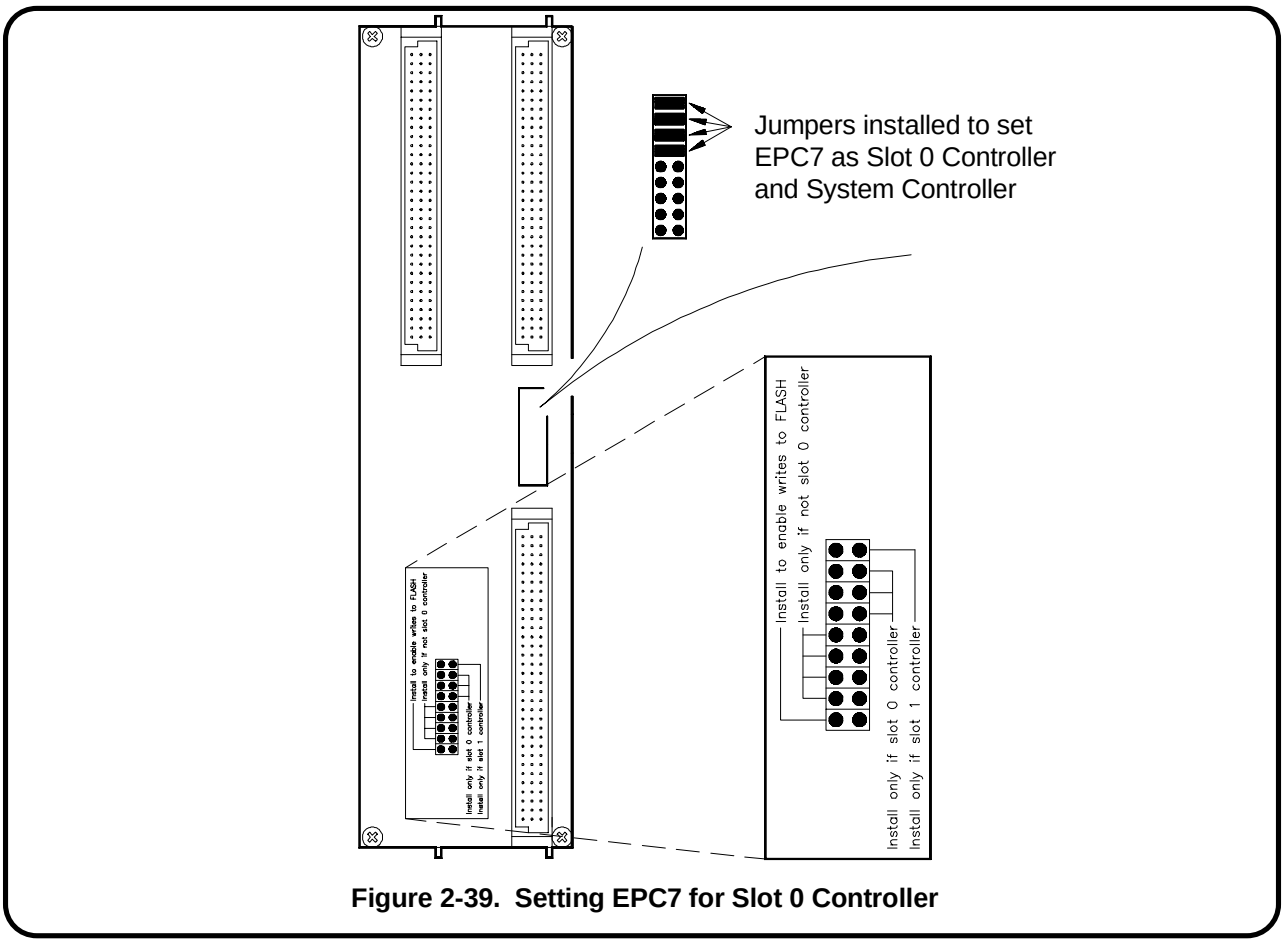

Jumpers installed to set
EPC7 as Slot 0 Controller
and System Controller
Install to enable writes to FLASH
Install only if not slot 0 controller
Install only if slot 0 controller
Install only if slot 1 controller

Figure 2-39. Setting EPC7 for Slot 0 Controller

Slot 0 functionality is used during operation for the following purposes:

- locate where modules are installed in the mainframe.
- manage data flow across the VXIbus backplane busses
- provide the system clock (SYSCLK - 16 MHz)

See Appendix A, "Terms and Definitions," for additional information on the slot 0 device. See the Agilent RADI-EPC7 documentation for information on other EPC7 Configurations.

NOTE *Once the EPC7 is set as the slot 0 device, it must then be installed in slots 0 and 1 of the mainframe.*

EPC7-1A : Set the EPC7 as Non-Slot 0 Device if Using Multiple Mainframes

If you are using multiple mainframes connected via MXIbus, the EPC7 Embedded Computer must be set as a Non-Slot 0 device. Therefore, you must change the following jumpers.

NOTE *Once the EPC7 is configured as a non-slot 0 device, it must NOT be installed in slot 0.*

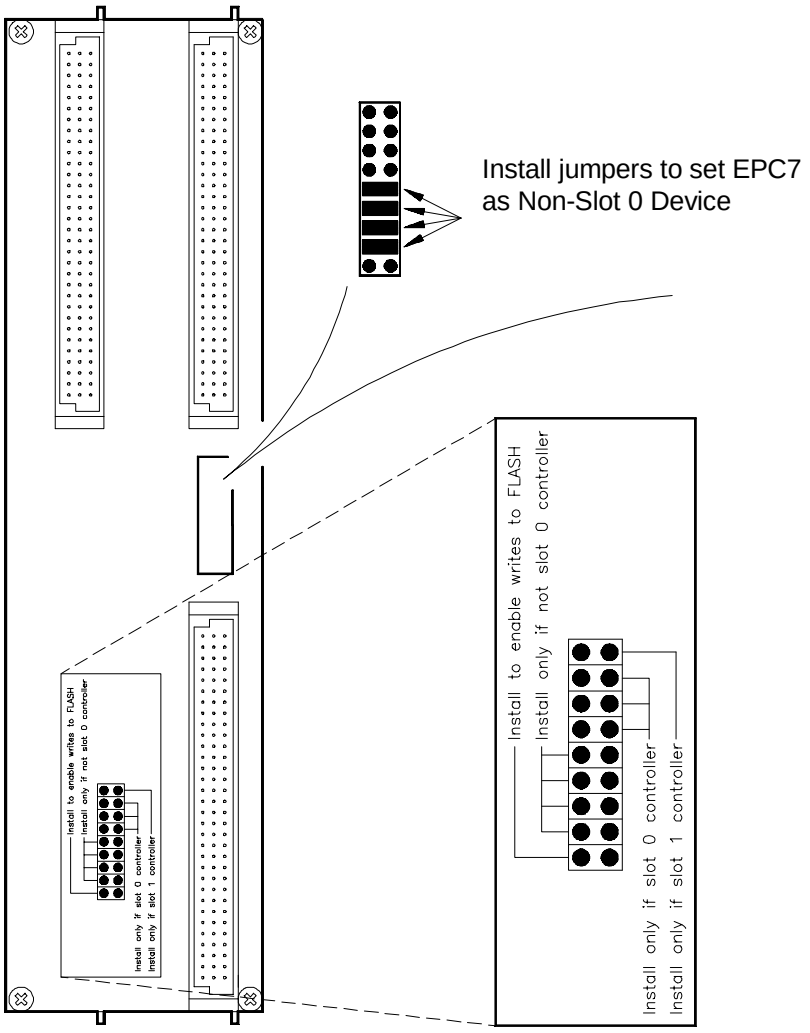

Install jumpers to set EPC7
as Non-Slot 0 Device
Install to enable writes to FLASH
Install only if not slot 0 controller
Install only if slot 0 controller
Install only if slot 1 controller

Figure 2-40. Setting EPC7 as Non-Slot 0 Device

EPC7-2 : Install the EPC7 into the Mainframe

Use the following procedure to install the Agilent RADI-EPC7 Embedded Computer into slots 0 and 1 of the mainframe.

NOTE *If you are using multiple mainframes via MXIbus, install the VXI-MXI module into slot 0 (according to "Procedure 3 : Set Up Your System for Multiple Mainframes") and the EPC7 into slots 1 and 2.*

---

1. Turn off mainframe power by pressing the button in the lower left corner of the mainframe.
2. Insert the module into the mainframe by aligning the top and bottom of the EPC7 with the card guides inside the mainframe. Slowly push the EPC7 straight into the slots until it seats in the backplane receptacles. The front panel of the EPC7 should be even with the front panel of the mainframe.
3. Tighten the retaining screws on the top and bottom edges of the front panel.

NOTE *The EPC7 has a front panel key that prevents its insertion next to certain other types of modules. This is done to prevent problems associated with incompatible signal levels on the VXI daisy-chained Local Bus. See the Agilent RADI-EPC7 documentation for more information.*

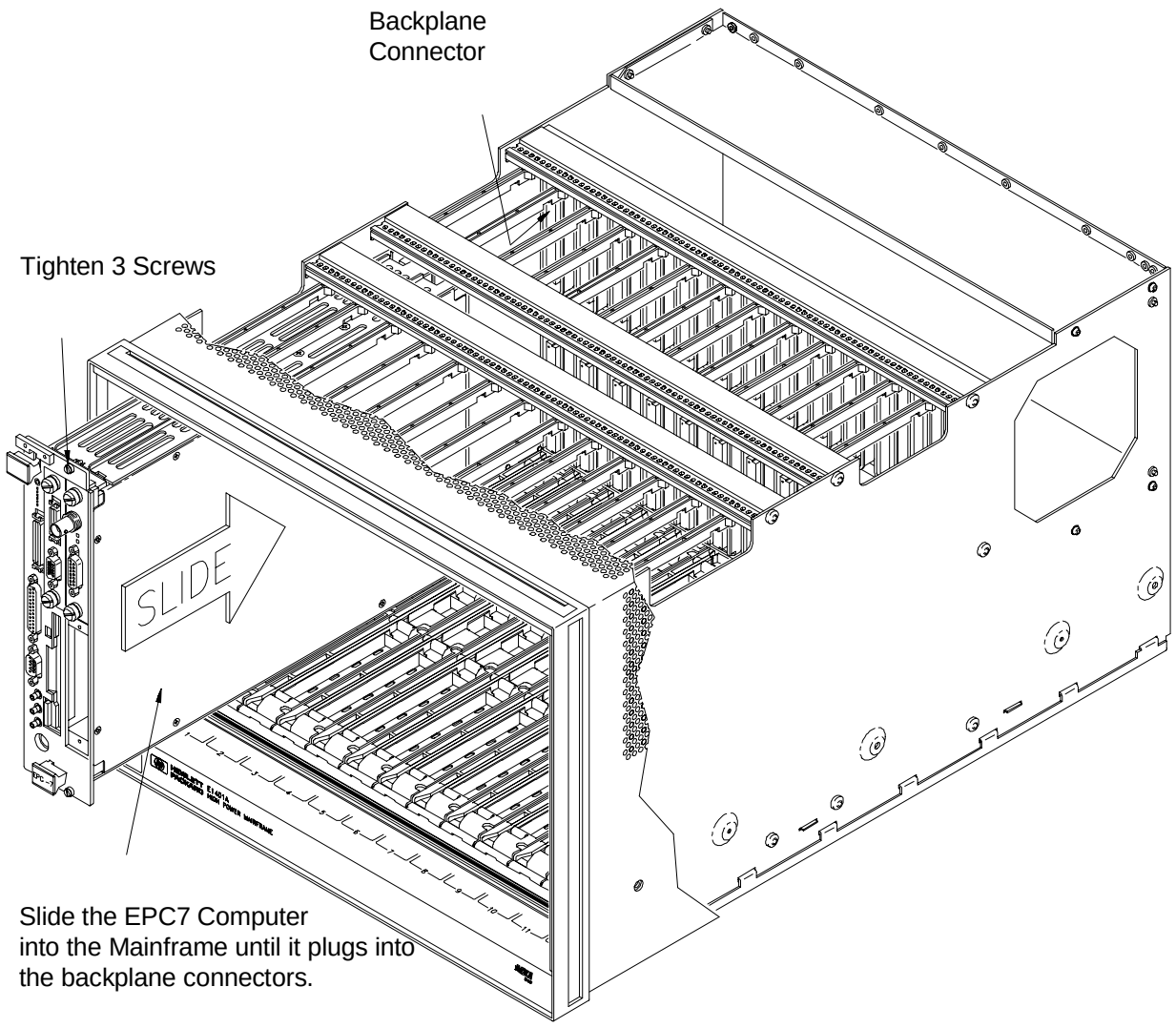


Figure 2-41. Installing EPC7 into Mainframe

EPC7-3 : Install EXM Expansion Modules

EXM expansion modules are used for video controllers, network interfaces, and GPIB interfaces. Some EXM modules come already installed. However, if you have an EXM module that needs to be installed, use the following procedure:

1. Turn off mainframe power by pressing the button at the bottom left corner of the mainframe.
2. Slide the EXM module into place in the card guides.
3. Push firmly on the EXM module front panel to insert its rear connector.
4. Tighten the thumb screws on the EXM's faceplate.

NOTE *When inserting a EXM module, avoid touching the circuit board and make sure you are operating in a static-free environment.*

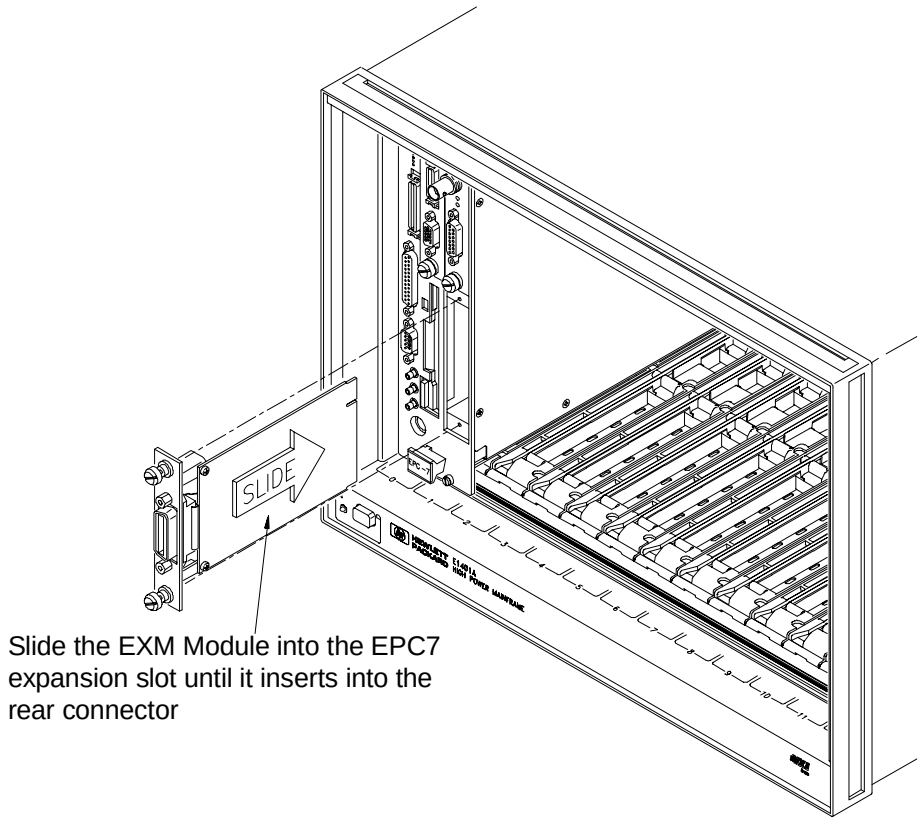


Figure 2-42. Installing an EXM Module

EPC7-4 : Configure the Command Module to Work with the EPC7

When you are using a Command Module in your system to interpret SCPI commands for the register-based instruments, you must configure your Command Module as a non-slot 0 device. The steps involved are as follows:

- Set the Command Module's Logical Address
- Set the Command Module's Servant Area
- Set the Command Module's Primary GPIB Address
- Disable the Command Module's slot 0 and System Controller Capability

In a VXIbus system with an EPC7 computer and Agilent E1406A Command Module, it is recommended that the EPC7 functions as the resource manger and slot 0 device, and that the E1406A Command Module be a servant of the EPC7. The resource manager and slot 0 functions and commander/servant hierarchy concepts are covered in Appendix A, "Terms and Definitions."

If you need to assign selected instruments to report to the Command Module in the Commader/Servant Hierarchy, see the "Agilent RADI-EPC7 Embedded Computer" section in Procedure 5, "Apply Power."

EPC7-4A : Set the Command Module's Logical Address

Set the Command Module's logical address to 1, 2, or 3.

Since the EPC7 is acting as resource manager and slot 0 device, its logical address is set to 0. The Command Module has a factory default logical address of 0 and must be changed.

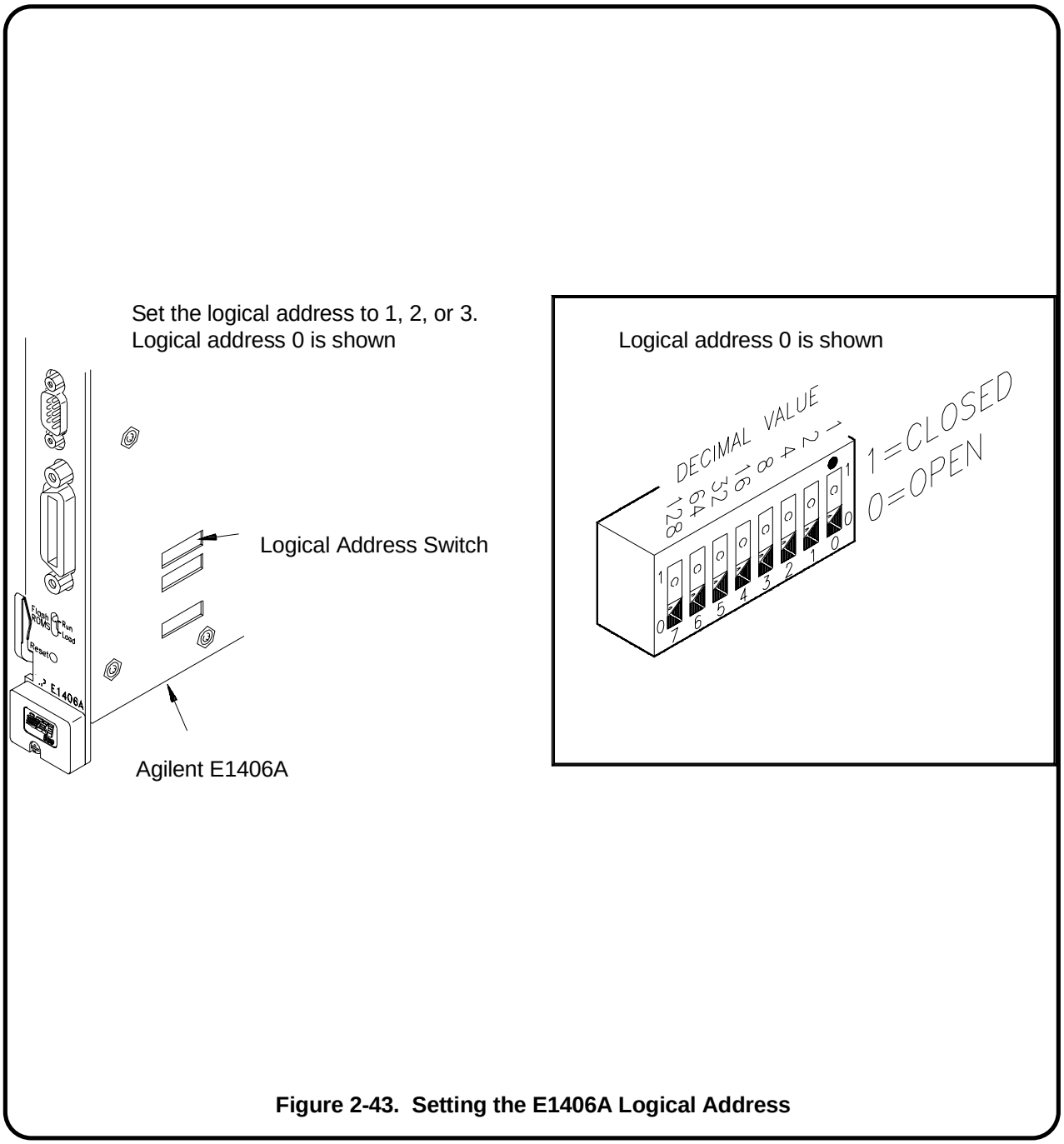


Figure 2-43. Setting the E1406A Logical Address

EPC7-4B : Set the Command Module's Servant Area

Notice the following when setting the Command Module servant area:

- For the Command Module to be the commander of a register-based module, the register-based module's logical address must fall within the Command Module's servant area. The servant area of the Command Module is determined as:

  Servant area = (**logical address + 1**) through (**logical address + servant area switch setting**)

- The logical address plus the Command Module's servant area cannot exceed 255. Therefore, set the servant area based on the logical addresses of the register-based modules in your system. For example, if the Command Module's logical address is 1 and its servant area switch is set to 100, the Command Module would be the commander for all modules with logical address from 2 through 101.

See Appendix A, "Terms and Definitions," for more information on the servant area.

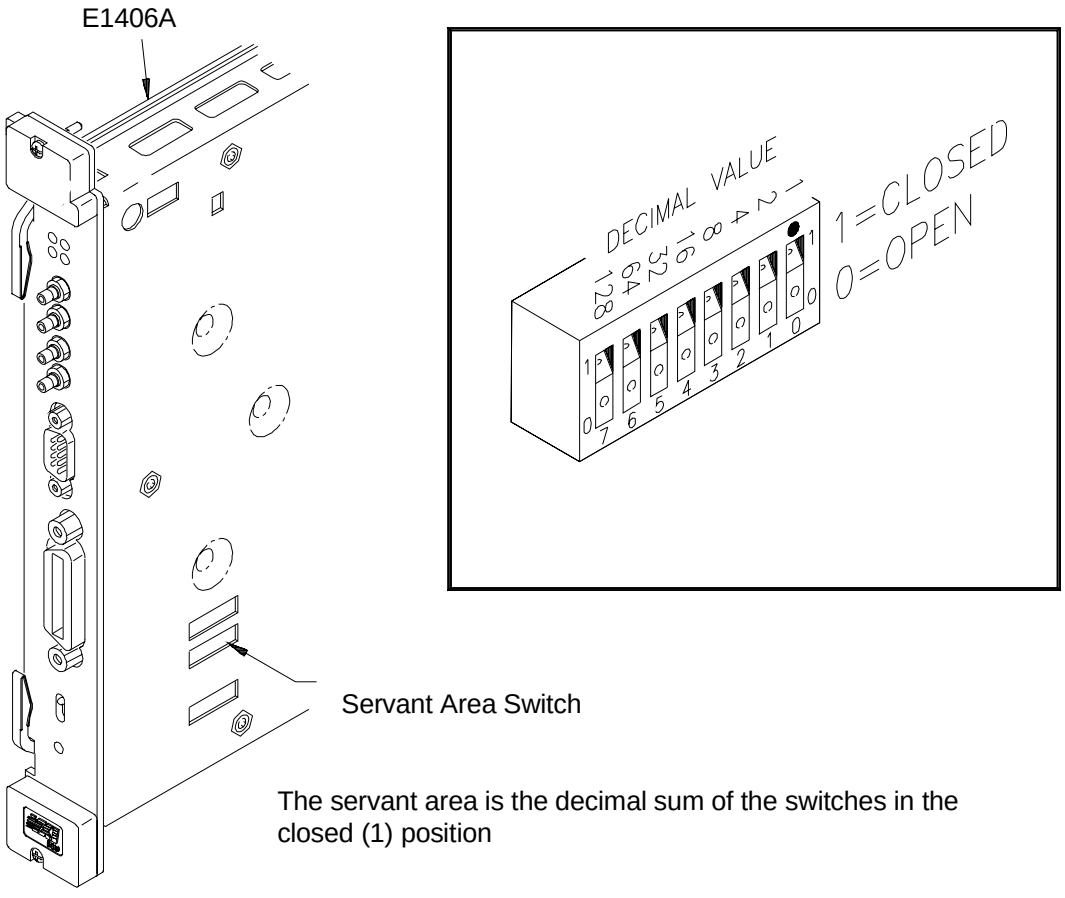

E1406A
DECIMAL VALUE
128 64 32 16 8 4 2 1
1=CLOSED
0=OPEN
7 6 5 4 3 2 1 0
Servant Area Switch
The servant area is the decimal sum of the switches in the closed (1) position

Figure 2-44. Setting the E1406 Servant Area

EPC7-4C : Set the Command Module's Primary GPIB Address

Register-based modules in the servant area of the Command Module are accessed from the EPC7 across GPIB and through the Agilent E1406A Command Module. The primary GPIB address identifies the GPIB port on the Command Module. This address is combined with the Command Module's secondary GPIB address (always 00), and with the EPC7 computer's (GPIB) interface select code (typically 7), to form the Command Module's complete GPIB address.

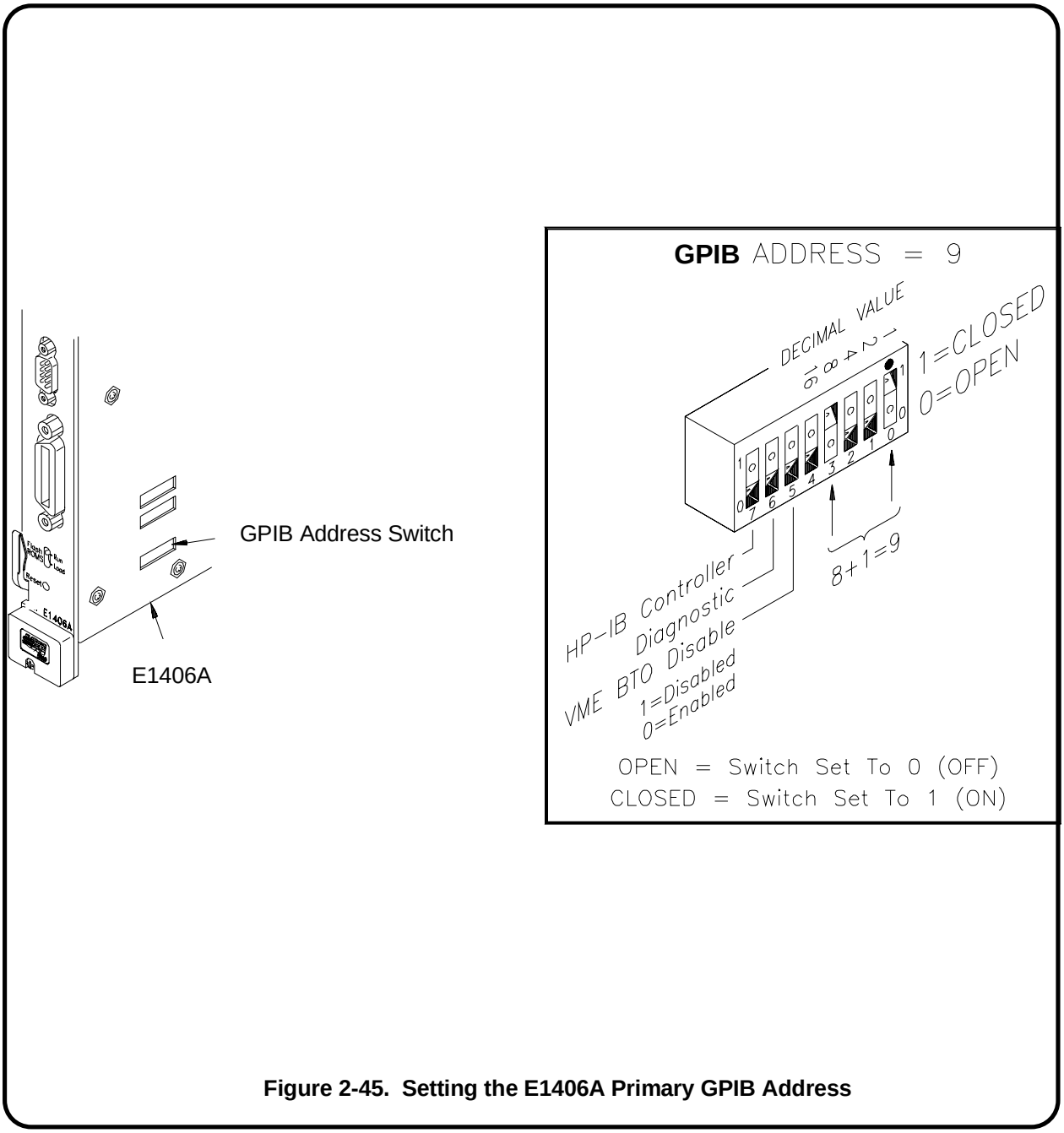


Figure 2-45. Setting the E1406A Primary GPIB Address

EPC7-4D : Disable the Command Module's slot 0 and System Controller Capability

Because the EPC7 contains the resource manager and slot 0 functionality, these functions must be disabled on the Command Module. This is done by setting the "System Controller" and "Slot 0" switches to the "Disable" position.

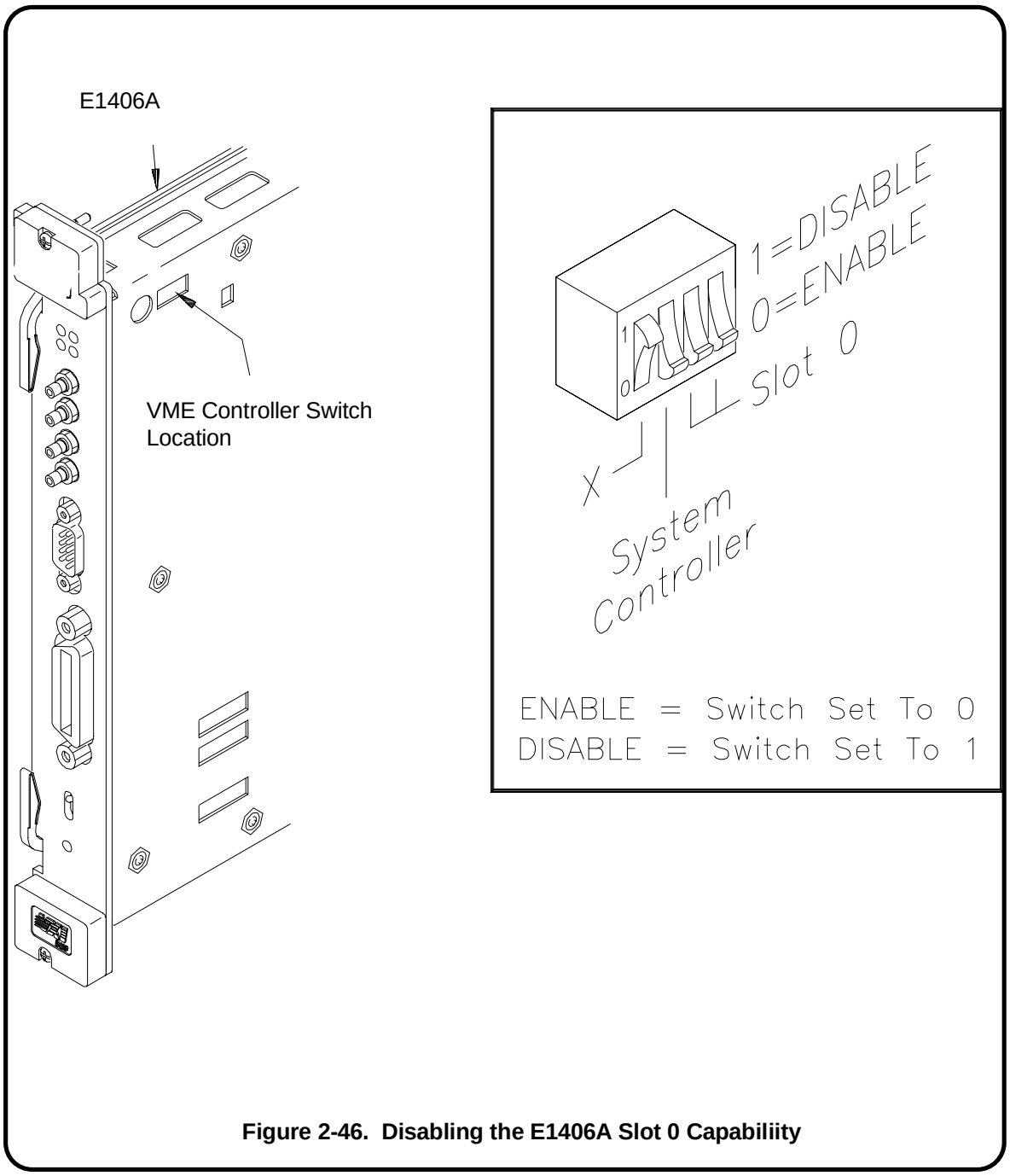


Figure 2-46. Disabling the E1406A Slot 0 Capabiliity

EPC7-5 : Connect Interface Cables

Connect the cable from the monitor and the keyboard to the EPC7. Tighten the screws on the connector.

NOTE *The monitor requires an EXM-6 or EXM-13 video controller module. VGA compatible and multiscan monitors can be used with the EXM-6 and EXM-13. Consult the reference manuals on these modules for more information.*

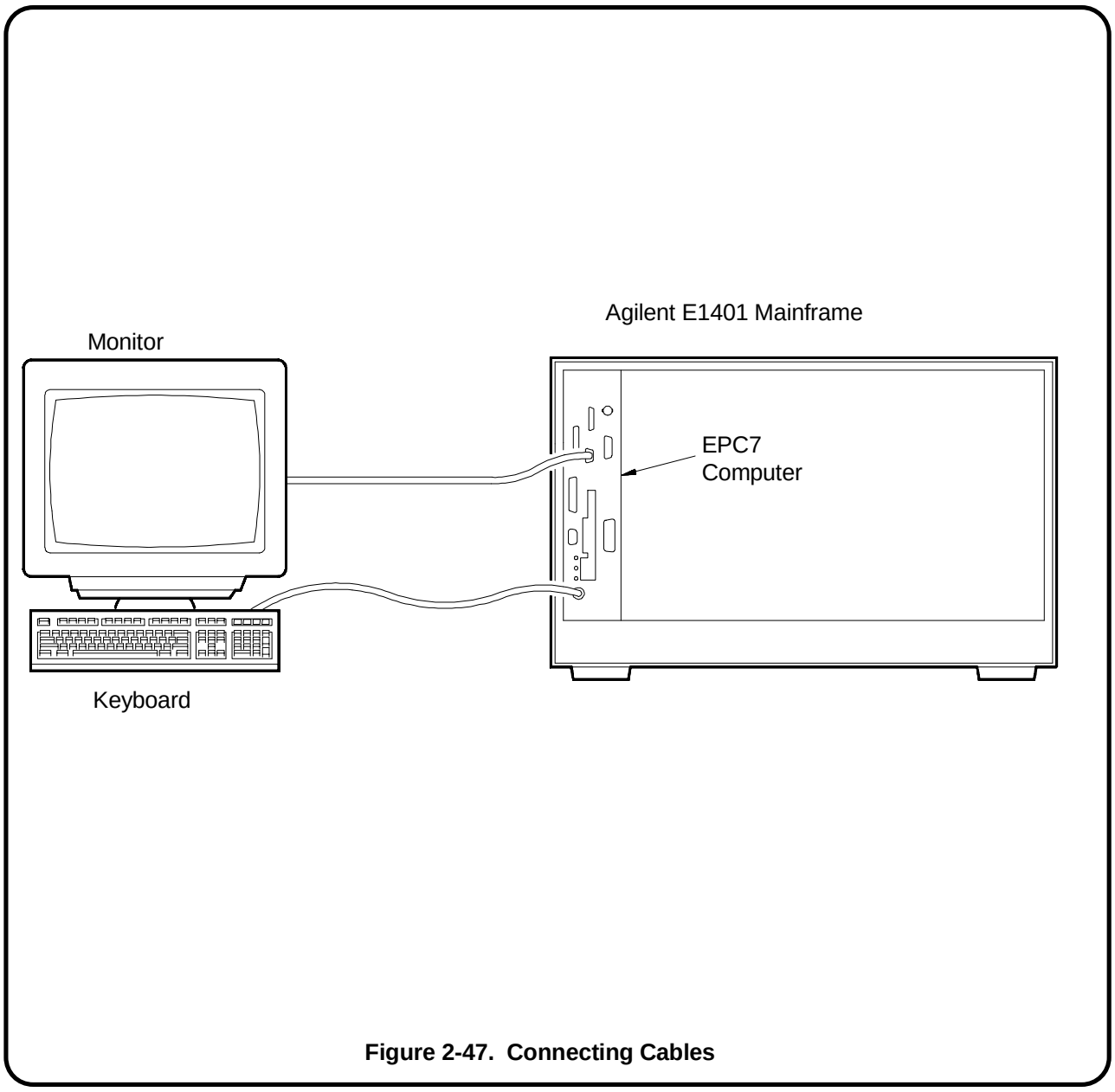


Figure 2-47. Connecting Cables

EPC7-6 : Apply Power

When power is applied to the mainframe, the Start-Up Resource Manager (SURM) on the EPC7 will execute. An example of the configuration sequence is shown in Figure 2-48.

Use the Pg Up / Pg Dn keys to view the entire configuration. Pay particular attention to the Slot Reporting and ULA (Unique Logical Address). These items will help you confirm a proper installation. Press ESC to exit the EPC7 start-up Resource Manager.

When you have a Agilent RADI-EPC7 and a Command Module in the same system, you may want to change the commander/servant hierarchy so that selected instruments report to the Command Module instead of the EPC7. See the "Agilent RADI-EPC7 Embedded Computer" section in Procedure 5, "Apply Power," for information on this procedure.

NOTE *Refer to the EPConnect/VXI for DOS User's Guide for more information on the Agilent RADI-EPC7 resource manager configuration sequence and for information on configuration and start up errors.*

```
                                VXI System Configuration

- - All Devices - -
NAME                ULA       BUS.SL    MANUFACTURER MODEL          A32/A24 MEMORY
TopCmdr             S000        0.00    RadiSys Corp EPC-7 S0       400000-7FFFFF

- - Memory Devices - -
NAME                TYPE      SUBTYPE          PRIV   SPEED              BLKT D32

- - Message Devices - -                                                  BNO STATES
NAME                CMD'R     SIGREG    MASTER      INT'R  FASTHS     SHMEM      SELF  SVNTS
TopCmdr               X         X          X           X                X         NA    NA

- - Slot Report - -      root mainframe
                        0  1  2  3  4  5  6  7  8  9  10  11  12
EMPTY/NONVXI               X  X  X  X  X  X  X  X  X  X   X   X
OPERATING               X
NON-OPERATING
INDETERMINATE
VXI 1.3

Commander/Servant Hierarchy
TopCmdr


- - Interrupt Map - -                          IRQ
Device Name         Interrupter          7 6 5 4 3 2 1          Handler
TopCmdr                                                         [H1]
TopCmdr                                                         [H2]
TopCmdr                                                         [H3]
TopCmdr                                                         [H4]
TopCmdr                                                         [H5]
TopCmdr                                                         [H6]
TopCmdr                                                         [H7]

- - ULA usage and bus traversal map - -
bus     ula
  0     000     TopCmdr
        . . .
        . . .
  0     255     *vacant*

- - A24 usage and bus traversal map - -
bus low-high addresses
0   000000-3fffff       *vacant*
0   400000-7fffff       TopCmdr
0   800000-ffffff       *vacant*

- - A32 usage and bus traversal map - -
bus low-high addresses
0   00000000-ffffffff   *vacant*

=== Bottom ===
```

Figure 2-48. RADI-EPC7 Resource Manager Configuration Sequence

EPC7-7 : Where To Go Next

So far you should have done the following:

- Configured the Agilent RADI-EPC7 as a Slot 0 (or Non-Slot 0 for multiple mainframes) Device
- Installed the EPC7 into the mainframe
- Installed EXM expansion modules
- Installed the Command Module (optional)
- Connected cables
- Applied power and verified installation

Once you have completed this procedure, continue with one of the following procedures:

If you have multiple mainframes connected via MXIbus:

- "**Procedure 3: Set Up Your System for Multiple Mainframes**"

If you are using one mainframe:

- "**Procedure 4: Configure and Install Instruments**"

Procedure 3: Set Up the System for Multiple Mainframes

If you only have one mainframe, continue with the next procedure, **Procedure 4: Configure and Install Instruments**. Otherwise, if you are using MXIbus to connect to multiple mainframes, continue with this procedure.

This procedure describes the recommended MXIbus configurations for 2-frame and 3-frame MXIbus systems. The Agilent E1482B VXIbus Extender Module (VXI-MXI module) is shipped from the factory configured for installation into slot 0. In some cases, however, you must reconfigure the VXI-MXI module for non-slot 0 operation. This is described in the following procedure. This procedure consists of the following steps:

- MXIbus-1 : Set Up VXI-MXI Modules for Slot 0
- MXIbus-2 : Set Up VXI-MXI Modules for Non-Slot 0
- MXIbus-3 : Remove Terminating Networks from Middle VXI-MXI Modules
- MXIbus-4 : Set the VXI-MXI Module's Logical Address
- MXIbus-5 : Disable the VMEbus Timeout on Other Devices
- MXIbus-6 : Install VXI-MXI Modules into the Mainframe
- MXIbus-7 : Connect Interface Cables
- MXIbus-8 : Apply Power
- MXIbus-9 : What To Do Next

If you need any information on terms used in this manual, see Appendix A, "Terms and Definitions."

The following figure illustrates some typical 2- and 3-frame MXIbus systems:

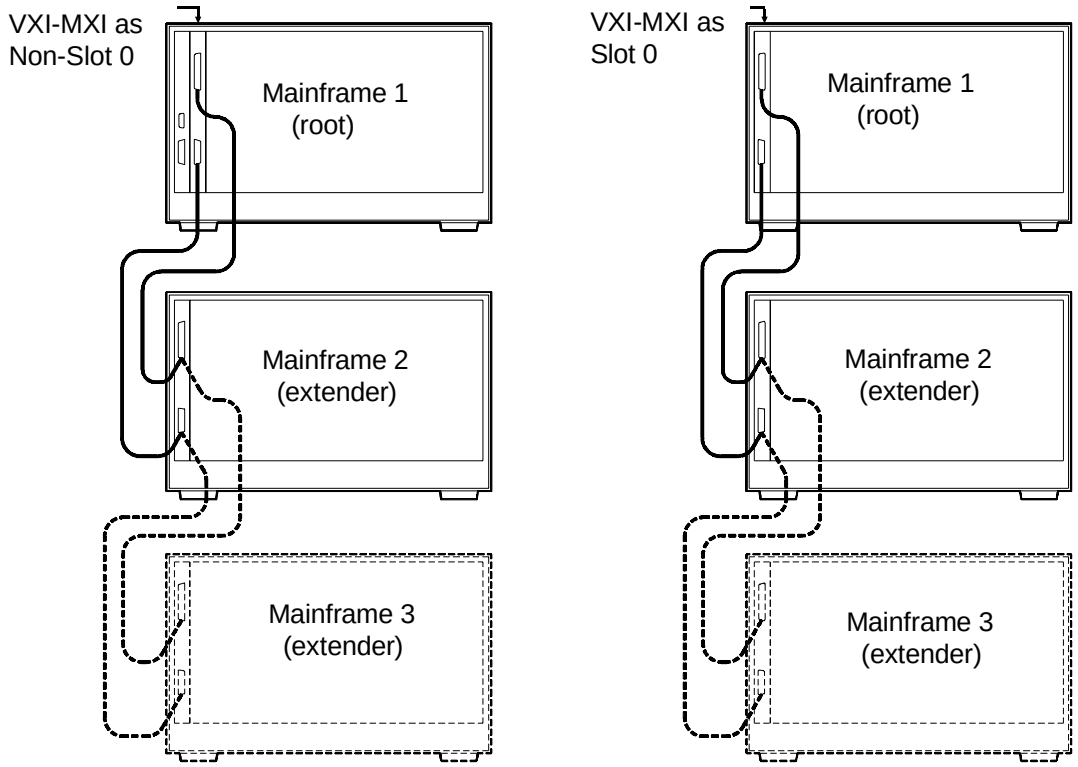


Figure 3-1. Looking at a Multiple Mainframe System

Notice that we've given each mainframe a number to identify its location in the MXIbus system. These numbers will be used throughout this chapter to describe different locations in the MXIbus system. Notice also that Mainframe 1 (the root mainframe) contains the system resource manager.

For more detailed information on VXI-MXI extender module configurations, refer to the *Agilent E1482A VXI-MXI Bus Extender User's Manual*.

CAUTION **Do not install a VXI-MXI module configured for Slot 0 into another slot without reconfiguring it for Non-Slot 0 use. Doing so can result in damage to the module, the VXIbus backplane, or both.**

The following table summarizes the VXI-MXI module's switch and jumper settings for slot 0 and non-slot 0 operation. Continue with this procedure for specific details on configuring the VXI-MXI module.

Table 3-1. Configuration Settings.

	Root or Extender Mainframe with VXI-MXI in Slot 0		Root Mainframe with E1406A, or V743 and VXI-MXI not in Slot 0		Root Mainframe with Agilent RADI-EPC7, and VXI-MXI in Slot 0	
Switch or Jumper	**Fig #**	**Description**	**Fig #**	**Description**	**Fig #**	**Description**
Switches S1, S8 (VXIbus Slot 0)	3-4a	Slot 0	3-4b	Non-slot 0	3-4a	Slot 0
MXIbus Terminating Resistor Networks	3-10	Remove unless last device in the daisy chain	3-10	Installed	3-10	Remove unless last device in the daisy chain
INTX Terminating Resistor Networks	3-10	Remove unless last device in the daisy chain	3-10	Installed	3-10	Remove unless last device in the daisy chain
Jumpers W1, W2, W3, W4, W5 (VMEbus Request Level)		Level 3 requester				
Jumper W6 (VME BTO Level)	3-5a	VME timeout 100 µsec	3-5b	VME timeout 200 µsec	3-5b	VME timeout 200 µsec
Jumper W7 (VME BTO Chain Position)	3-7a	1 extender, slot 0	3-7b	1 extender, non-slot 0	3-7a	1 extender, slot 0
Switch S3 (Interlocked Arbitration)		Interlocked				
Switch S4 (MXIbus System Controller)	3-6a	Not MXIbus controller	3-6b	MXIbus controller	3-6b	MXIbus controller
Jumper W8 (MXI Controller Timeout Level)	3-9d	MXIbus timeout disabled	3-9a	MXIbus timeout 100 µsec	3-9a	MXIbus timeout 100 µsec
Switch S2 (MXIbus Fairness)		Fairness enabled				
Jumpers W9, W10 (CLK10 Source)	3-8a	On-board 10 MHz VXI-MXI installed in slot 0	3-8c	Do not source CLK10	3-8a	On-board 10 MHz VXI-MXI installed in slot 0
Switches W1, W2, W3 (CLK10 Mapping)		CLK10 mapping disabled				
Switch S6 (Ext Clk SMB)		Output external clock				
Switch S5 (Trigger Input Termination)		Trigger 50Ω terminated				
Switch S7 (Front Panel Pushbutton)		SYSRESET* asserted				

MXIbus-1 : Set Up VXI-MXI Modules for Slot 0

The VXI-MXI module is shipped from the factory configured for slot 0 operation. The VXI-MXI module should be configured for slot 0 operation in the following applications:

- when installed in extender mainframe 2 and 3
- when using the Agilent RADI-EPC7 Embedded Computer
- when using an external computer (e.g. HP 9000 Series 700) with an EISA/ISA to MXIbus interface card

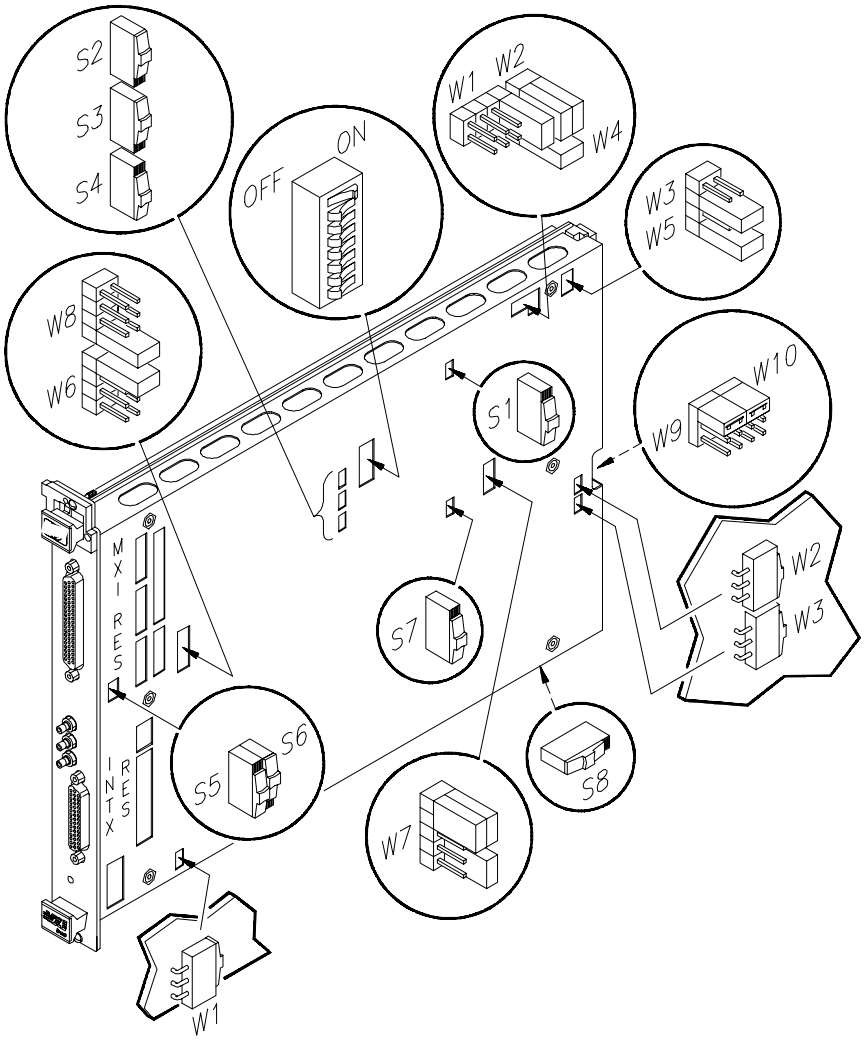


Figure 3-2. Slot 0 VXI-MXI Settings (DEFAULT)

MXIbus-2 : Set VXI-MXI Modules for Non-Slot 0

VXI-MXI modules installed in a root mainframe (mainframe 1) that does not contain an Agilent RADI-EPC7 or an external computer with an EISA/ISA to MXIbus interface card, need to be configured for non-slot 0 operation. When setting a VXI-MXI module for non-slot 0 operation be sure the module is configured as indicated in the center column in Table 3-1. The switch/jumper positions are shown on the next three pages.

Remember, if you have an EPC7 embedded computer or an external computer with an EISA/ISA to MXIbus interface card, the VXI-MXI module needs to be configured for slot 0 operation (MXIbus-1 : Set VXI-MXI Module for Slot 0 Operation, this is the default configuration).

NOTE *When installing the VXI-MXI module into a slot other than slot 0, you must change switches S1 and S8 to configure for non-slot 0 use or damage can occur.*

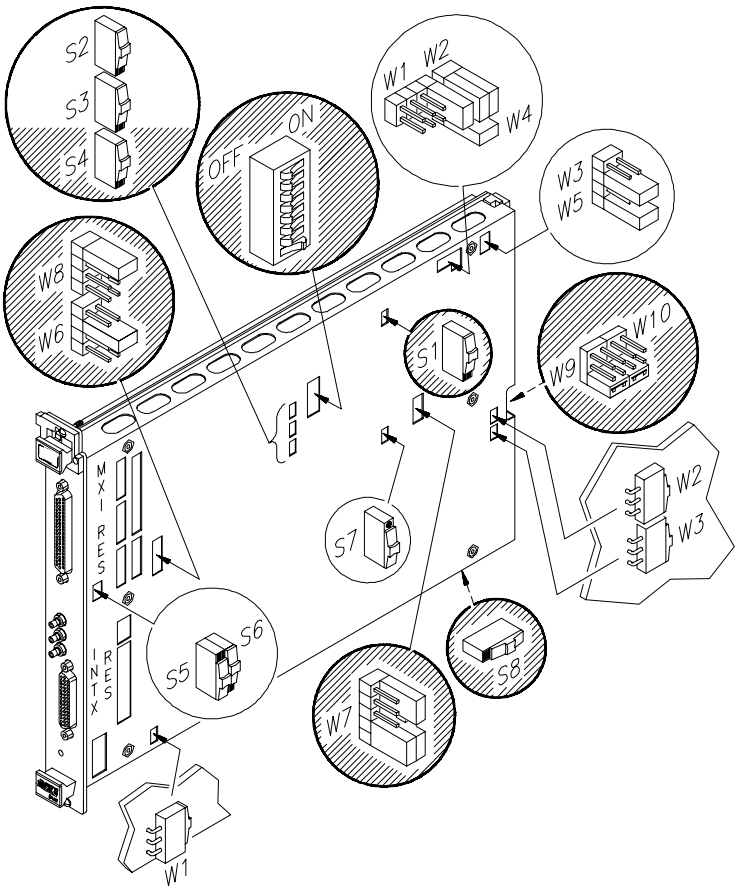


Figure 3-3. Non-Slot 0 VXI-MXI Settings

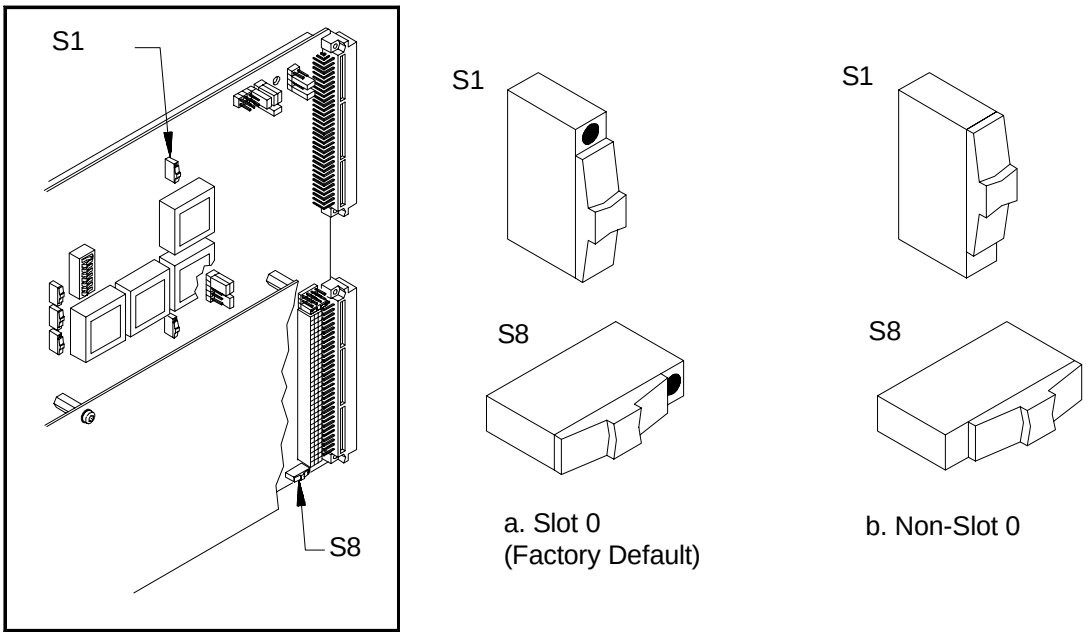


Figure 3-4. VXIbus Slot 0 Selection

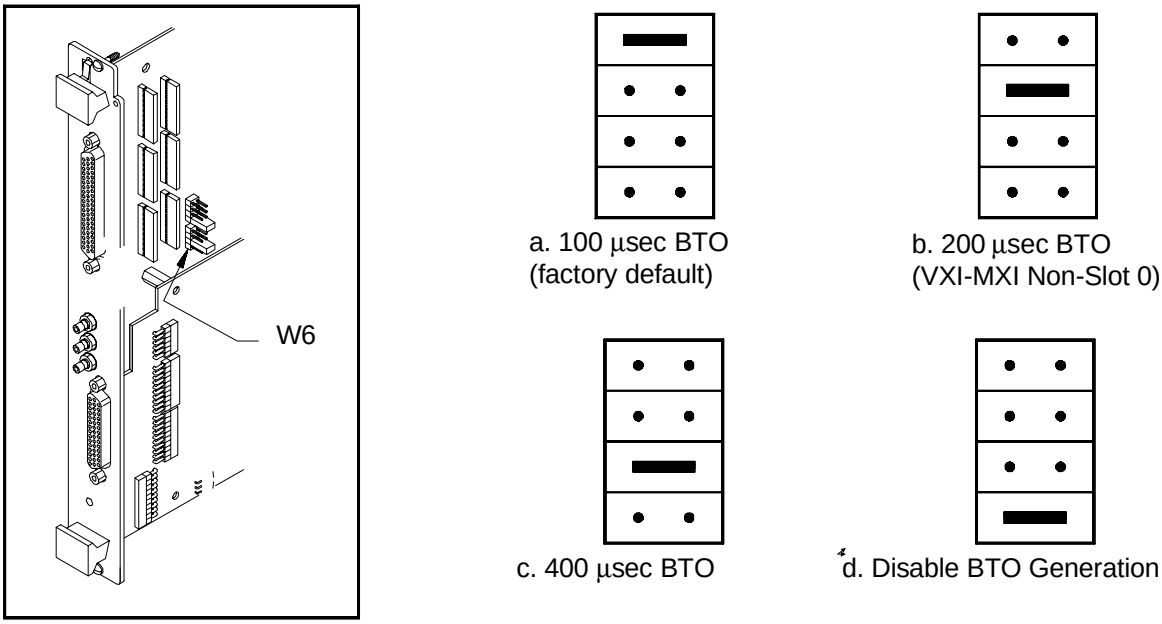
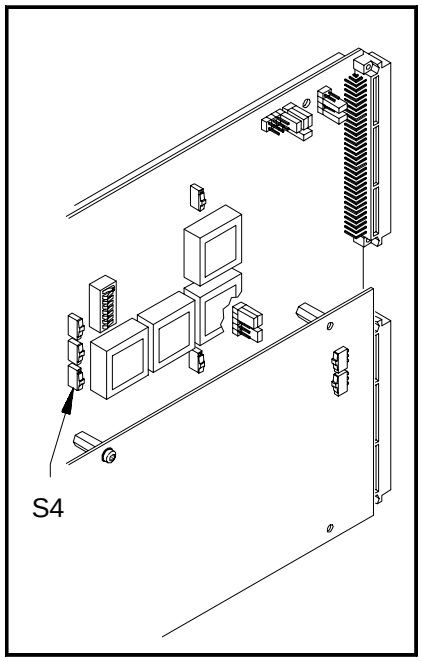
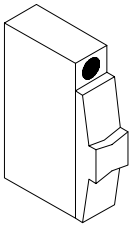
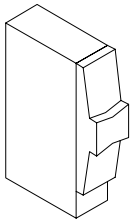


Figure 3-5. VMEbus Timeout Selection Jumpers



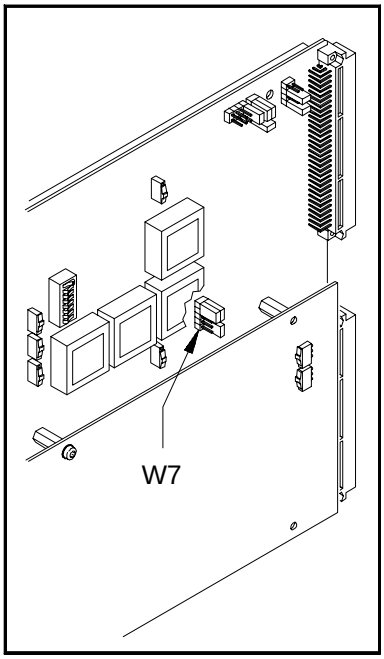
a. Not MXIbus System Controller
(Factory Default)



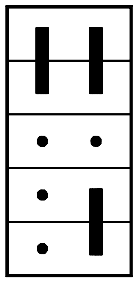


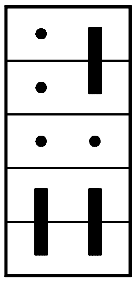
b. MXIbus System Controller
(VXI-MXI Non-Slot 0)

Figure 3-6. MXIbus System Controller Selection



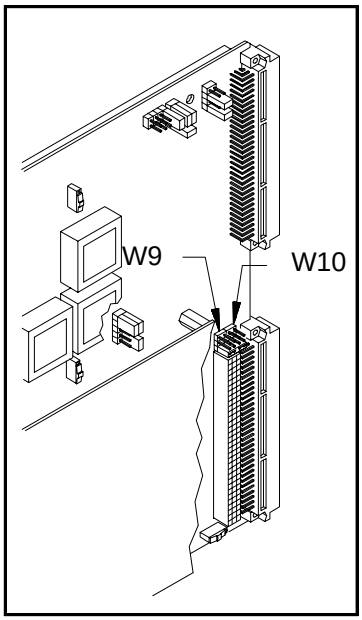
a. One extender, slot 0
(Factory Default)

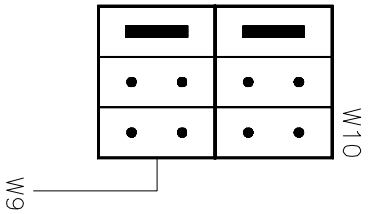




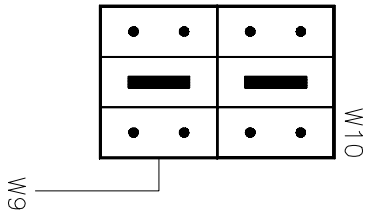
b. One extender, non-slot 0
(VXI-MXI Non-Slot 0)

Figure 3-7. VMEbus Timeout; One VXI-MXI in Mainframe

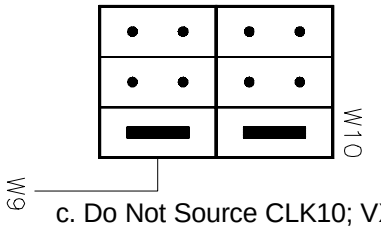




a.On-board 10 MHz VXI-MXI Installed in Slot 0 (Factory Default)

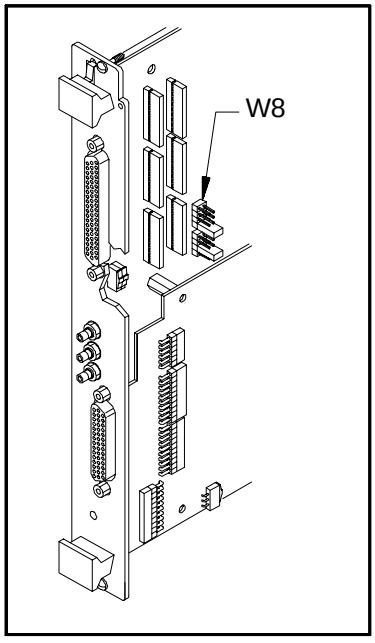


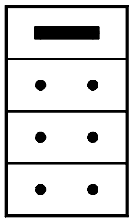
b. External Clock VXI-MXI Installed in Slot 0



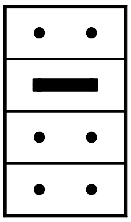
c. Do Not Source CLK10; VXI-MXI Not Installed in Slot 0 (VXI-MXI Non-Slot 0)

Figure 3-8. CLK10 Source Signal Options

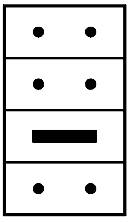




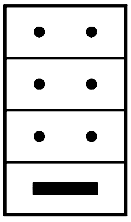
a. 100 µsec/msec MXIbus System Controller Timeout (VXI-MXI Non-Slot 0)



b. 200 µsec/msec MXIbus System Controller Timeout



c. 400 µsec/msec MXIbus System Controller Timeout



d. Disable MXIbus System Controller Timeout Generation (Factory Default)

Figure 3-9. MXIbus System Controller Timeout Selection

MXIbus-3 : Remove the Terminating Networks from Middle VXI-MXI Modules

If you have more than two mainframes, remove the MXI and INTX terminating networks from the VXI-MXI modules in the middle of the MXIbus daisy chain.

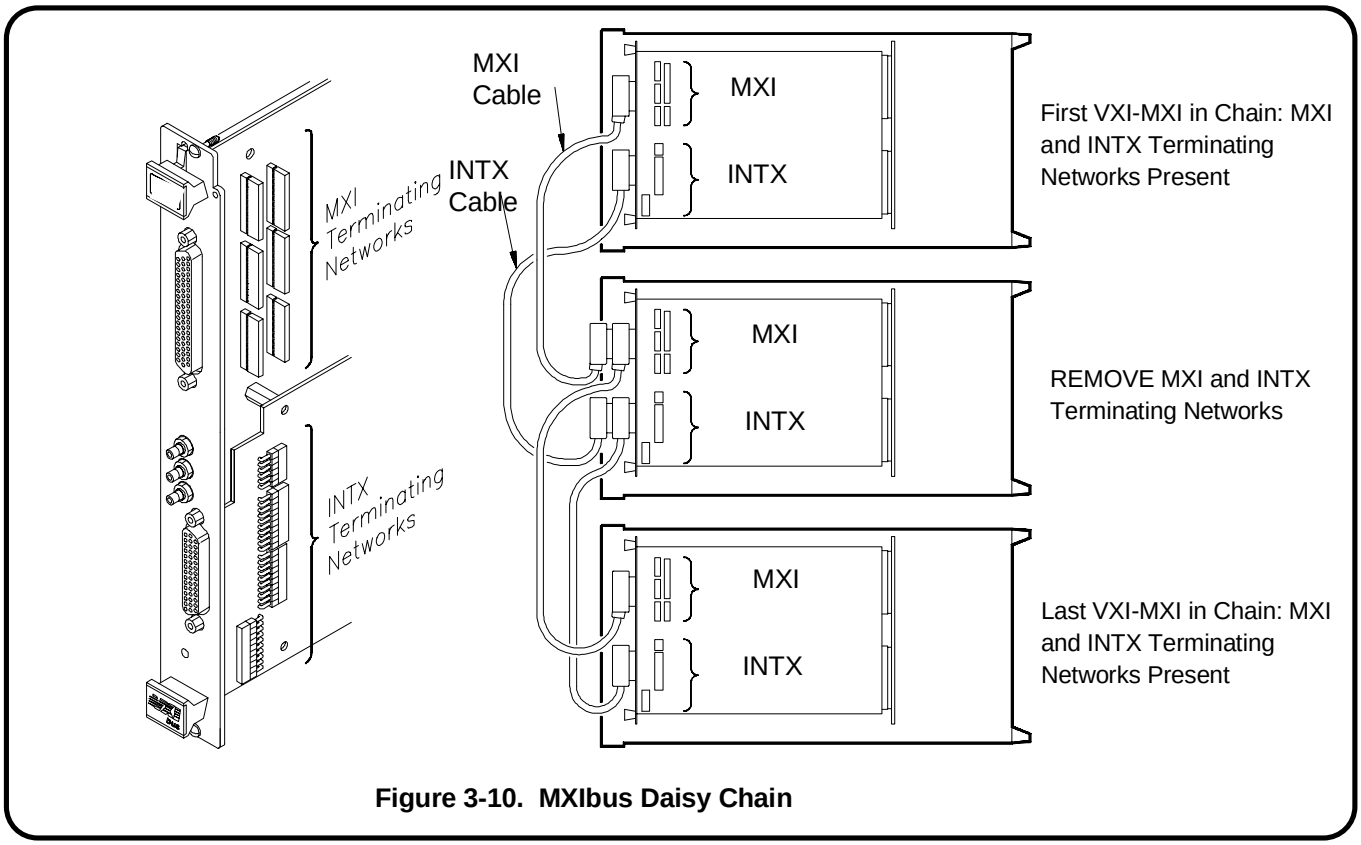


Figure 3-10. MXIbus Daisy Chain

The VXI-MXI is shipped from the factory with terminating SIP resistor networks installed. If the VXI-MXI will be the first or last device in the MXIbus daisy-chain, you should leave these internal terminators in place. If the VXI-MXI is not going to be an end device, the terminating resistor networks must be removed from their sockets and stored in a safe place in case the MXIbus system changes. All six MXIbus networks must be either installed or removed.

Like the MXIbus, the INTX cables have matched impedance and require termination networks at the first and last devices in the INTX chain. These terminations minimize the reflections caused by impedance discontinuities at the ends of the cable. The INTX daughter board comes with terminating resistors installed. If the daughter board is not going to be an end device, remove the terminating resistor network and store them with the MXI networks.

MXIbus-4 : Set the VXI-MXI Module's Logical Address

Set the logical address on your VXI-MXI modules by using the following steps:

1. Locate the logical address switch, an 8-bit DIP switch at U64. See Figure 3-11.
2. Determine your system configuration from the following figures:
   - 2-Frame System - Command Module (Figure 3-12)
   - 3-Frame System - Command Module (Figure 3-13)
   - 2-Frame - VXI-MXI (Figure 3-14)
   - 3-Frame - VXI-MXI (Figure 3-15)
   - 2-Frame - RadiSys EPC-7 (Figure 3-16)
   - 3-Frame - RadiSys EPC-7 (Figure 3-17)
   - 2-Frame - Agilent V743 (Figure 3-18)
   - 3-Frame - Agilent V743 (Figure 3-19)
3. Set the VXI-MXI logical address recommended in the above figures. Table 3-2 shows switch positions for some of the most commonly used VXI-MXI logical address.

NOTE *Since the VXI-MXI does not have VXIbus resource manager capability, do not set the logical address for the VXI-MXI to 0.*

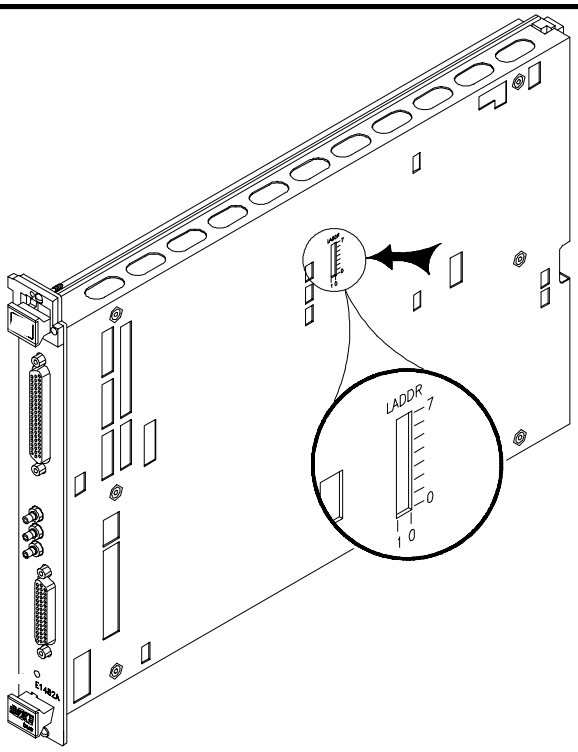
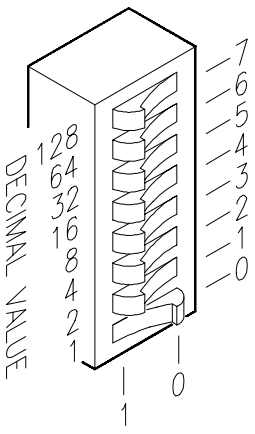
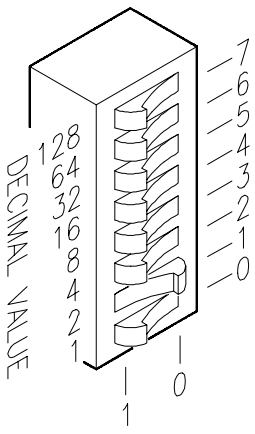
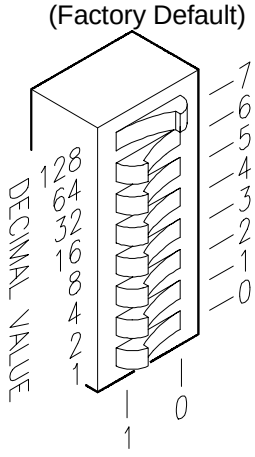
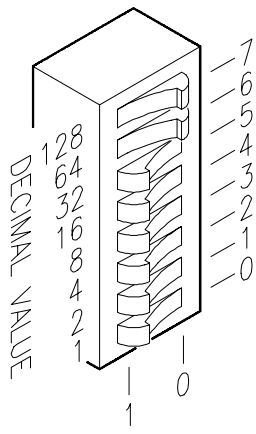


Figure 3-11. Logical Address Selection

Table 3-2. Typical Logical Addresses

LADDR = 1	LADDR = 2	LADDR = 128 (Factory Default)	LADDR = 192
			

Remember that logical address 0 or 255 is not allowed for the VXI-MXI module.

2-Frame System - Command Module with External Computer

NOTE *A system using a Command Module as the resource manager identifies instruments by an instrument identifier address. Instrument identifier addresses are those divisible by 8 and must be used if you are using an Agilent E1406A Command Module as the resource manager.*

- **MAINFRAME 1:** Set the VXI-MXI module to address 2. Set other VXI modules in the mainframe to addresses below 128. Note: The resource manager must be at address 0.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128.

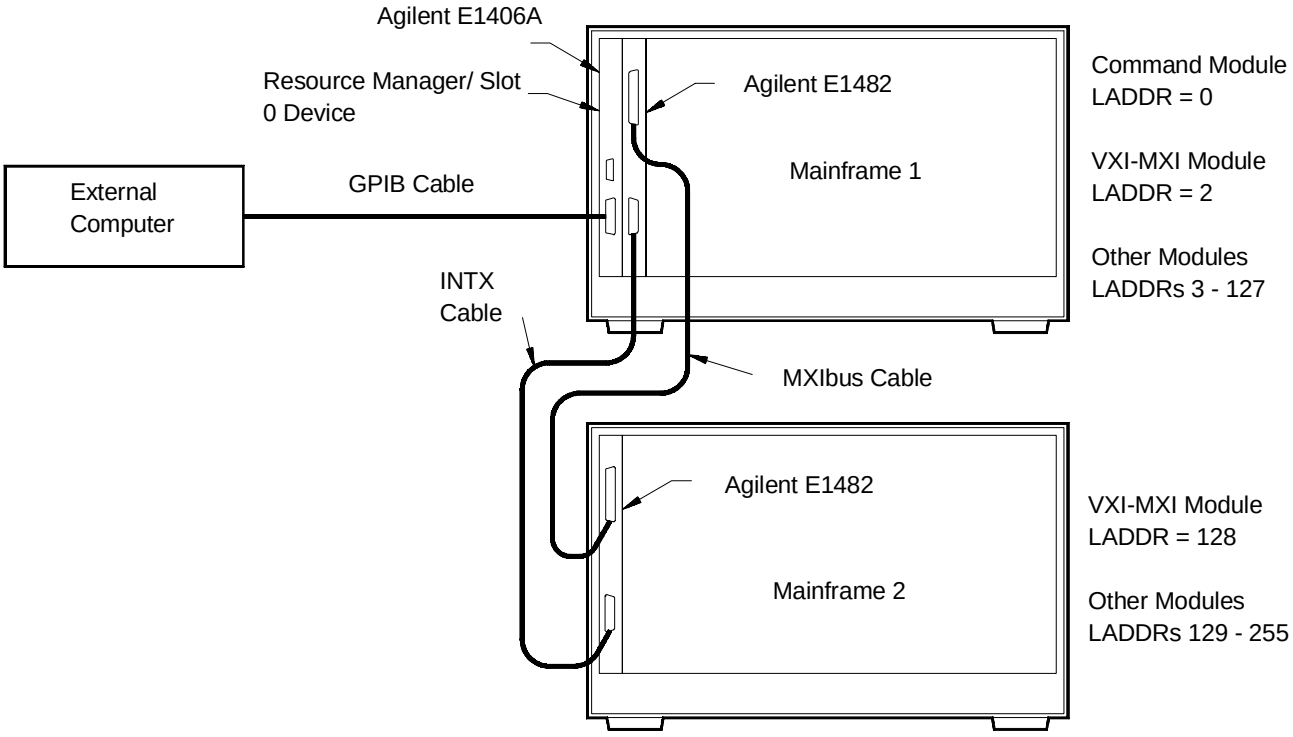


Figure 3-12. Command Module System, 2-Frame

3-Frame System - Command Module with External Computer

- **MAINFRAME 1:** Set the VXI-MXI module to address 2. It does not have to be an instrument identifier address. Set other VXI modules in the mainframe to addresses below 128. Note: the resource manager must be at address 0.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128. Set all other VXI modules to addresses between 128 and 191 (do not duplicate the VXI-MXI address).
- **MAINFRAME 3:** Set the VXI-MXI module address to 192. Set all other VXI modules to addresses between 192 and 255 (do not duplicate the VXI-MXI address).

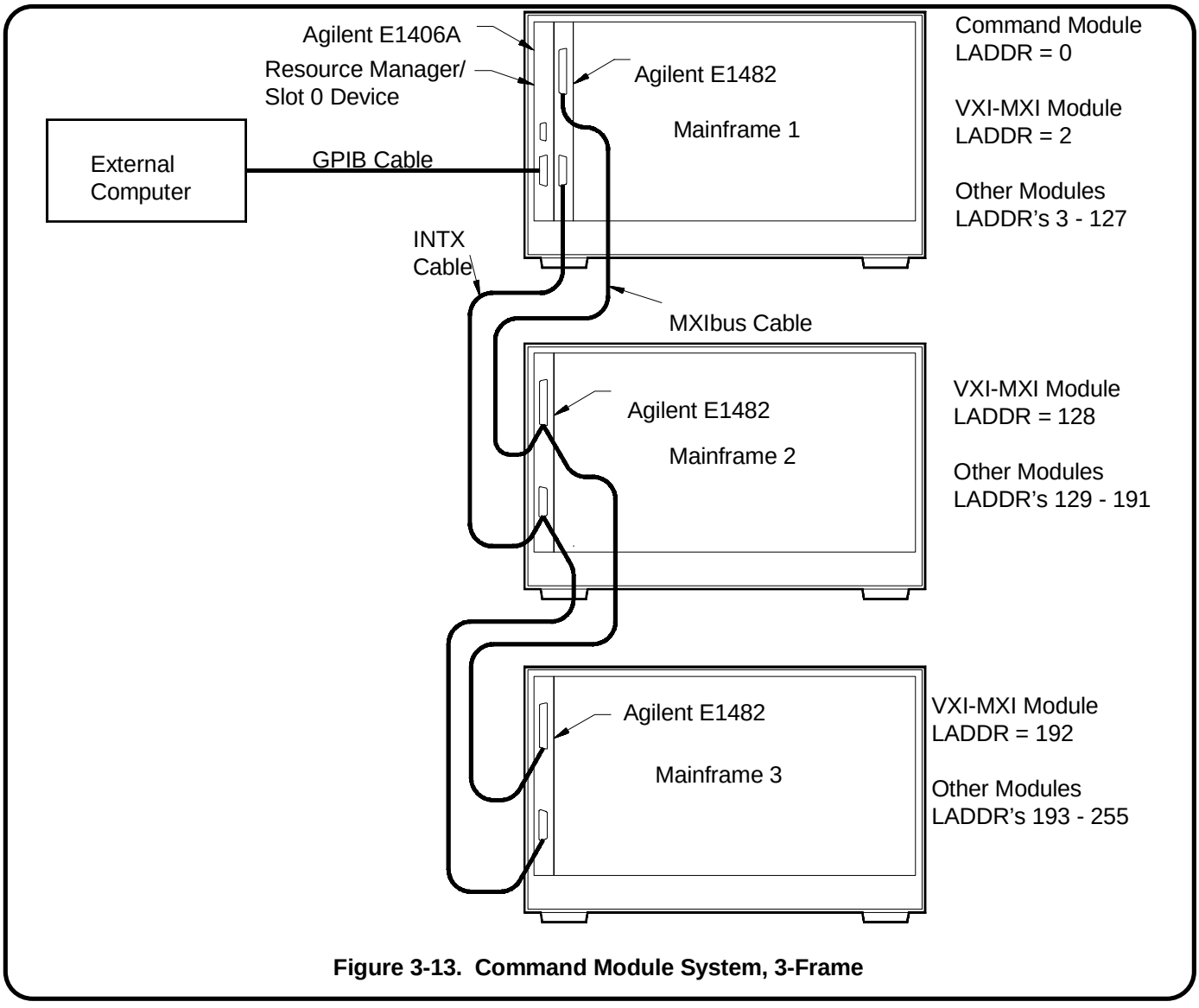


Figure 3-13. Command Module System, 3-Frame

2-Frame System - VXI-MXI with External Computer

- **MAINFRAME 1:** Set the VXI-MXI module to address 1. Set other VXI modules in the mainframe to addresses between 64 and 128.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128.

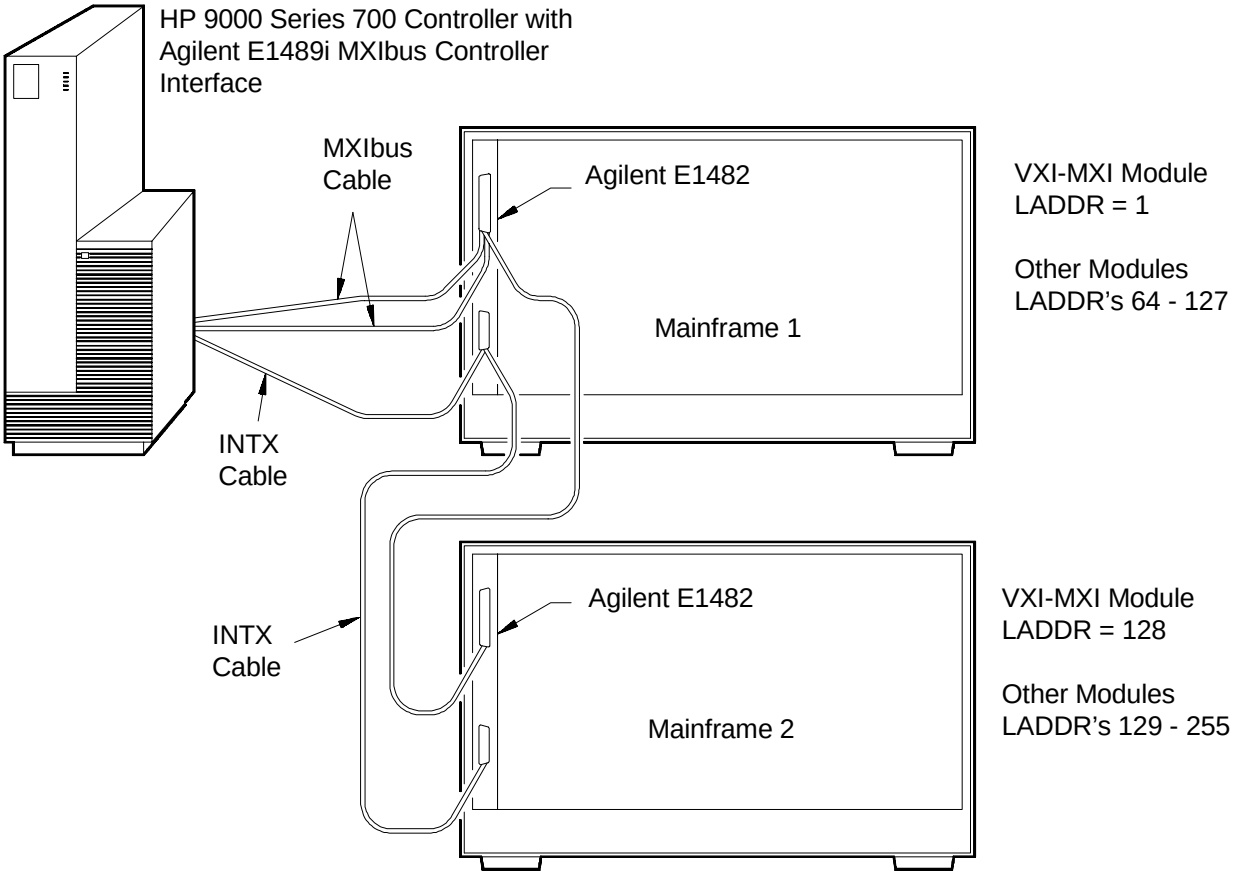


Figure 3-14. External Controller with VXI-MXI, 2-Frame

3-Frame System - VXI-MXI with External Computer

- **MAINFRAME 1:** Set the VXI-MXI module to address 2. It does not have to be an instrument identifier address. Set other VXI modules in the mainframe to addresses below 128.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128. Set all other VXI modules to addresses between 128 and 191 (do not duplicate the VXI-MXI address).
- **MAINFRAME 3:** Set the VXI-MXI module address to 192. Set all other VXI modules to addresses between 192 and 255 (do not duplicate the VXI-MXI address).

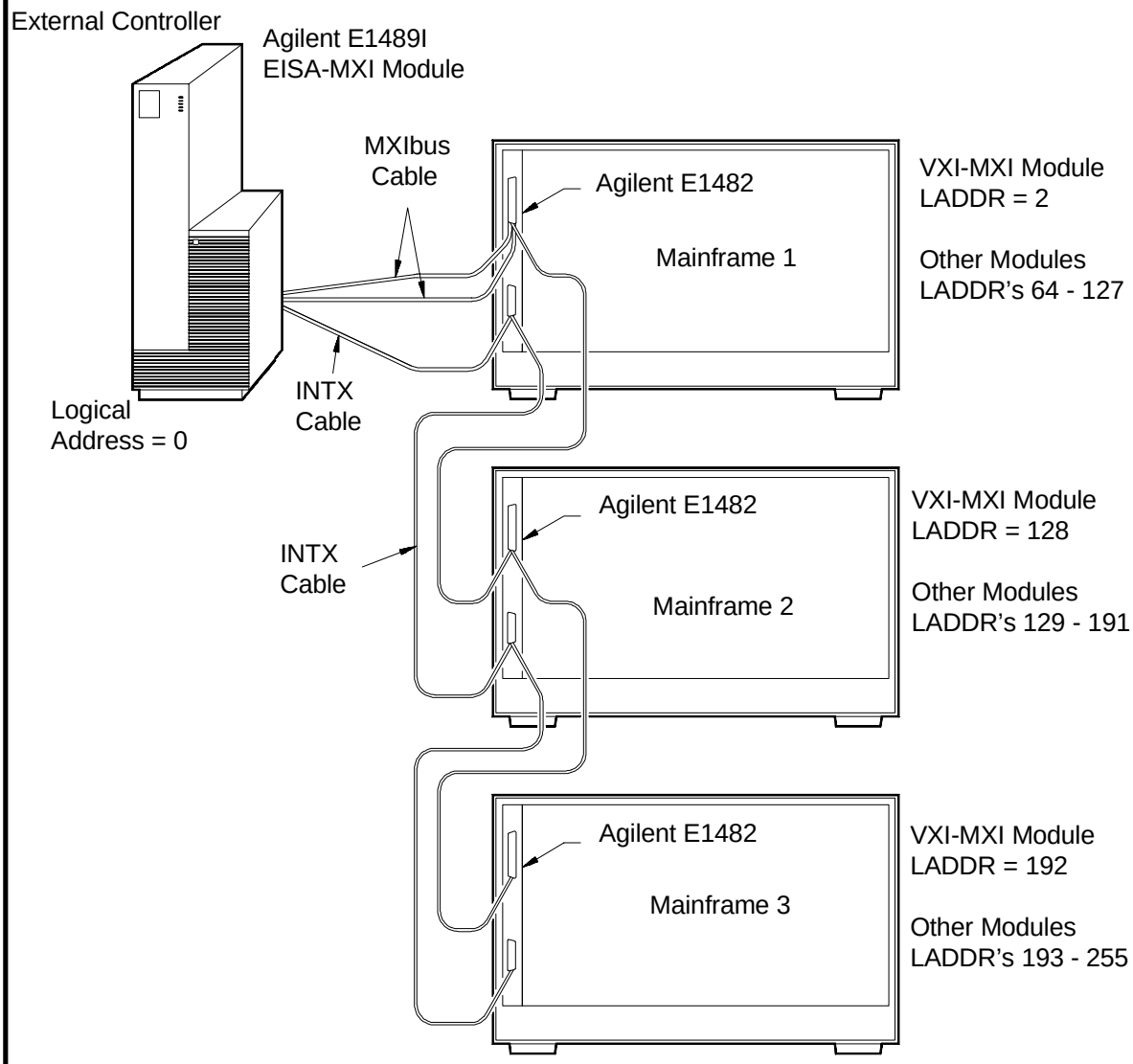


Figure 3-15. External Controller, 3-Frame

2-Frame System - Agilent RADI-EPC7 Embedded Computer

- **MAINFRAME 1:** Set the VXI-MXI module to address 1. Set other VXI modules in the mainframe to addresses below 128. Note - The EPC7 is installed in slots 1 and 2 and is configured as a non-slot 0 device.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128.
- Note - In two and three mainframe systems, the EPC7 Start Up Resource Manager (SURM) does not allow statically configured modules to be located at logical address 255.

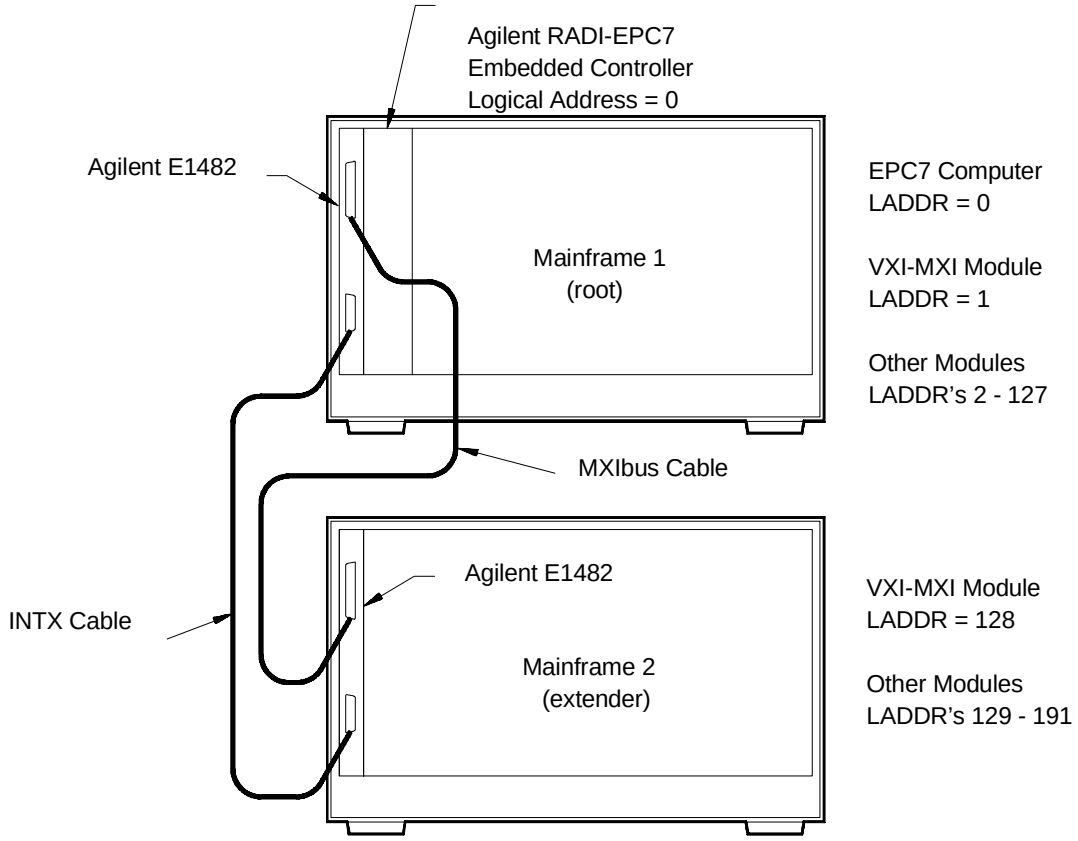


Figure 3-16. Embedded EPC7 System, 2-Frame

3-Frame System - Agilent RADI-EPC7 Embedded Computer

- **MAINFRAME 1:** Set the VXI-MXI module to address 1. It does not have to be an instrument identifier address. Set other VXI modules in the mainframe to addresses below 128. Note: The EPC7 is installed in slots 1 and 2 and configured as a non-slot 0 device.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128. Set all other VXI modules to addresses between 129 and 159 (do not duplicate the VXI-MXI address).
- **MAINFRAME 3:** Set the VXI-MXI module address to 160. Set all other VXI modules to addresses between 161 and 191 (do not duplicate the VXI-MXI address).

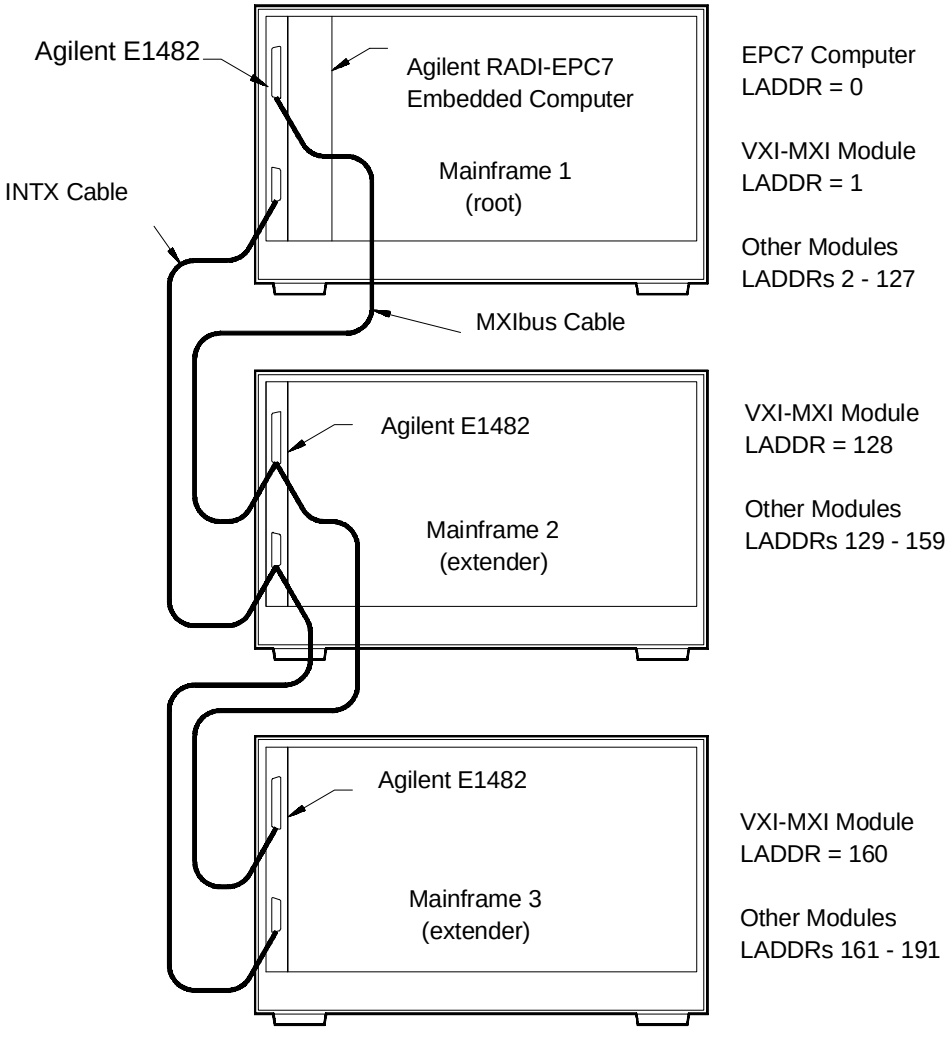


Figure 3-17. EPC7 Embedded Controller, 3-Frame

2-Frame System - Agilent V743 Embedded Controller

- **MAINFRAME 1:** Set the VXI-MXI module to address 1. Set other VXI modules in the mainframe to addresses below 128. Note: The resource manager must be at address 0.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128.

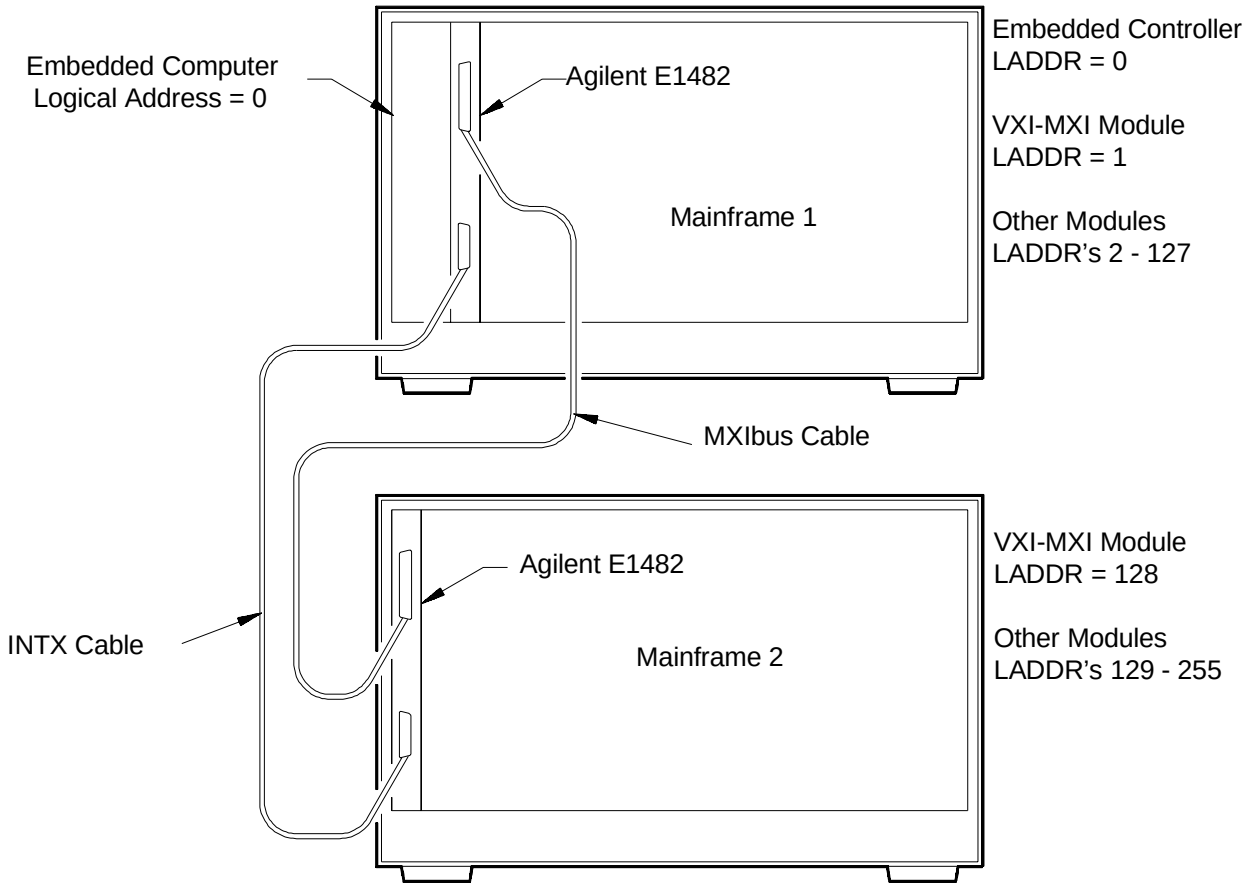


Figure 3-18. Embedded V743 2-Frame

3-Frame System - Agilent V743 Embedded Controller

- **MAINFRAME 1:** Set the VXI-MXI module to address 2. It does not have to be an instrument identifier address. Set other VXI modules in the mainframe to addresses below 128. Note: the resource manager must be at address 0.
- **MAINFRAME 2:** Set the VXI-MXI module address to address 128. Set all other VXI modules to addresses between 128 and 191 (do not duplicate the VXI-MXI address).
- **MAINFRAME 3:** Set the VXI-MXI module address to 192. Set all other VXI modules to addresses between 192 and 255 (do not duplicate the VXI-MXI address).

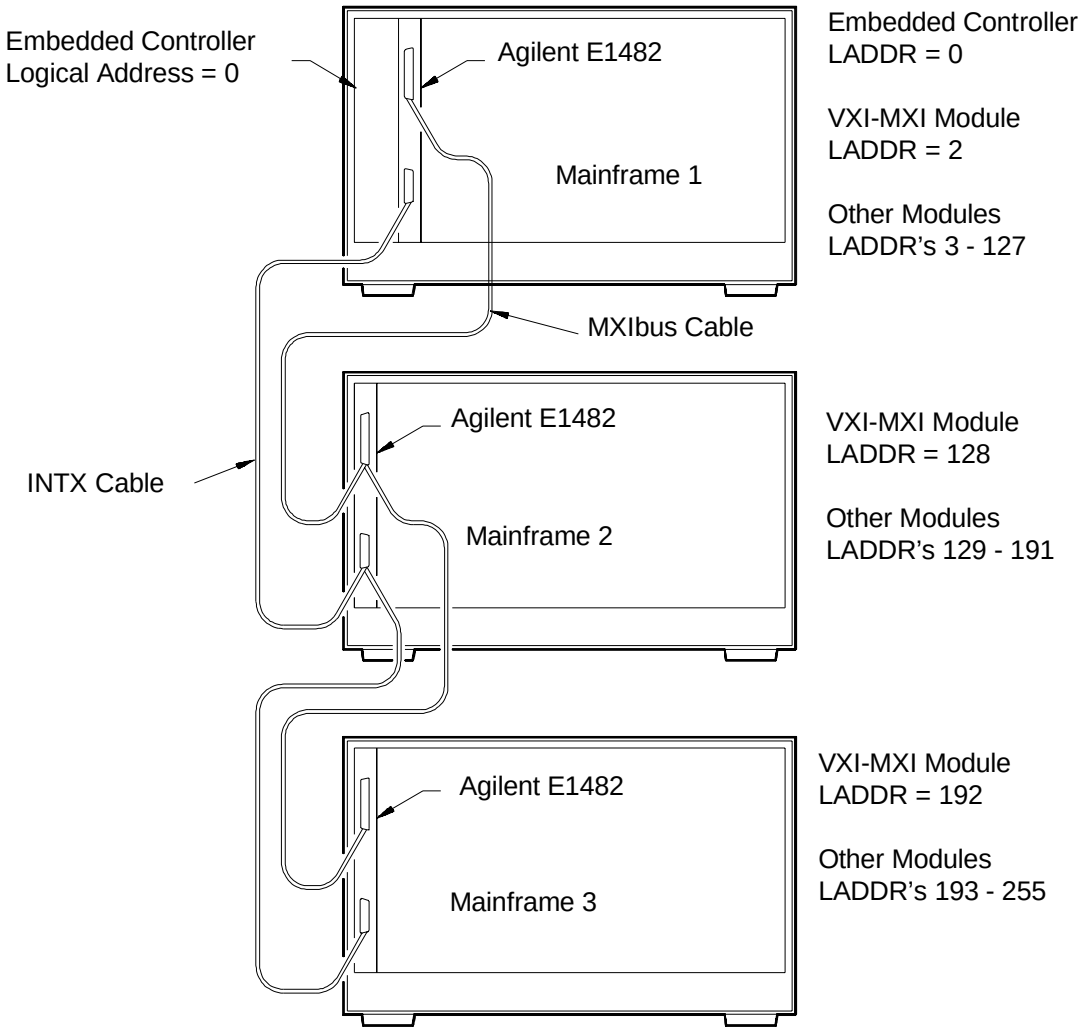


Figure 3-19. Embedded V743, 3-Frame

MXIbus-5 : Disable the VMEbus Timeout on Other Modules (VME BTO)

The VXI-MXI module must do the VMEbus timeout on all mainframes. You MUST disable the VME BTO on any other device in your system. The VME BTO must be disabled on the following:

- Agilent E1406A Command Module
- Agilent RADI-EPC7 Embedded Computer

NOTE *You must disable the VMEbus timeout on any VXI module used in the VXI-MXI system. Any module with the VME BTO enabled will not allow the system to be configurable. Only the VXI-MXI module in each mainframe can have the VME BTO enabled.You do not have to disable the VMEbus timeout on the Agilent V743/64 and V743/100 embedded controllers.*

Disable VMEbus Timeout - Agilent E1406A Command Module

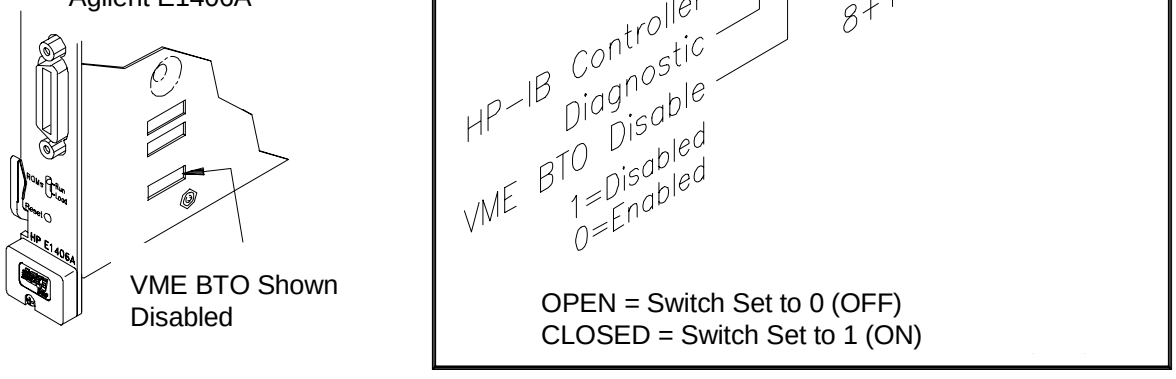


Figure 3-20. Disabling VMEbus Timeout, Command Module

Disable VMEbus Timeout- Agilent RADI-EPC7 Embedded Computer

NOTE *When using a Agilent RADI-EPC7 Computer with multiple mainframes, the VXI-MXI Module must be installed in slot 0 (and configured as slot 0 device), and the EPC7 must be installed in slots 1 and 2 (and configured as a non-slot 0 device)*

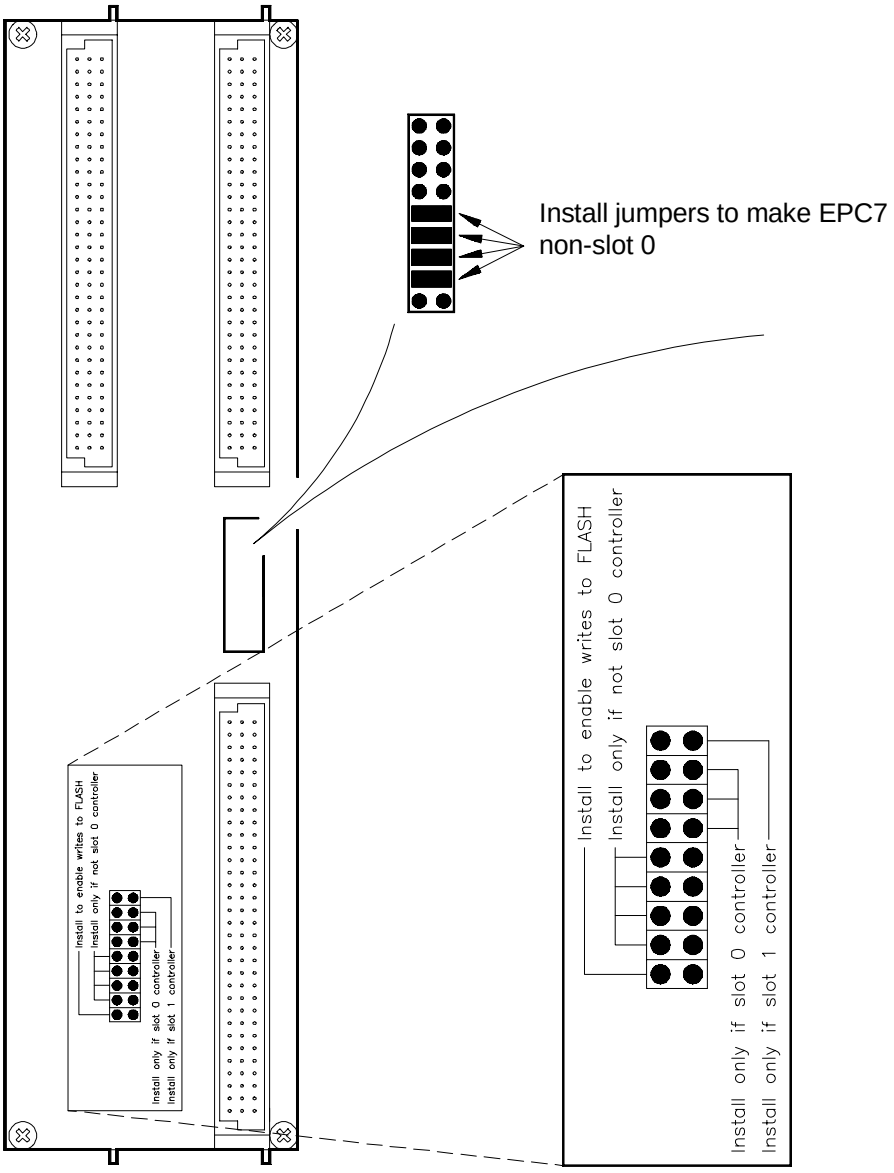

Install jumpers to make EPC7 non-slot 0
Install to enable writes to FLASH
Install only if not slot 0 controller
Install only if slot 0 controller
Install only if slot 1 controller

Figure 3-21. Disabling VMEbus Timeout, HP RADI-EPC7

MXIbus-6 : Install VXI-MXI Modules into Mainframes

Use the following steps to install the VXI-MXI Modules into the mainframes. Install VXI-MXI modules in mainframes 2 and 3 into slot 0 of the mainframe. Install VXI-MXI module in mainframe 1 into the slot next to the slot 0 device unless the VXI-MXI module needs to be the slot 0 device (when EPC7 or EISA/ISA to MXIbus is used). See Figure 3-23 on the next page.

NOTE *If you have an EPC7 embedded computer or an external computer with an EISA/ISA to MXIbus interface card, the VXI-MXI module in mainframe 1 needs to be installed in slot 0 (and configured as a slot 0 device).*

---

1. Turn off mainframe power by pressing the button in the bottom left corner of the mainframe.
2. If the modules will be installed into a D-Size mainframe, install a support designed for installing C-Size cards in D-Size mainframes.
3. Insert the module into the mainframe by aligning the top and bottom of the card with the card guides inside the mainframe. Slowly push the module straight into the slot until it seats in the backplane receptacles. The front panel of the module should be even with the front panel of the mainframe.
4. Tighten the retaining screws on the top and bottom edges of the front panel.

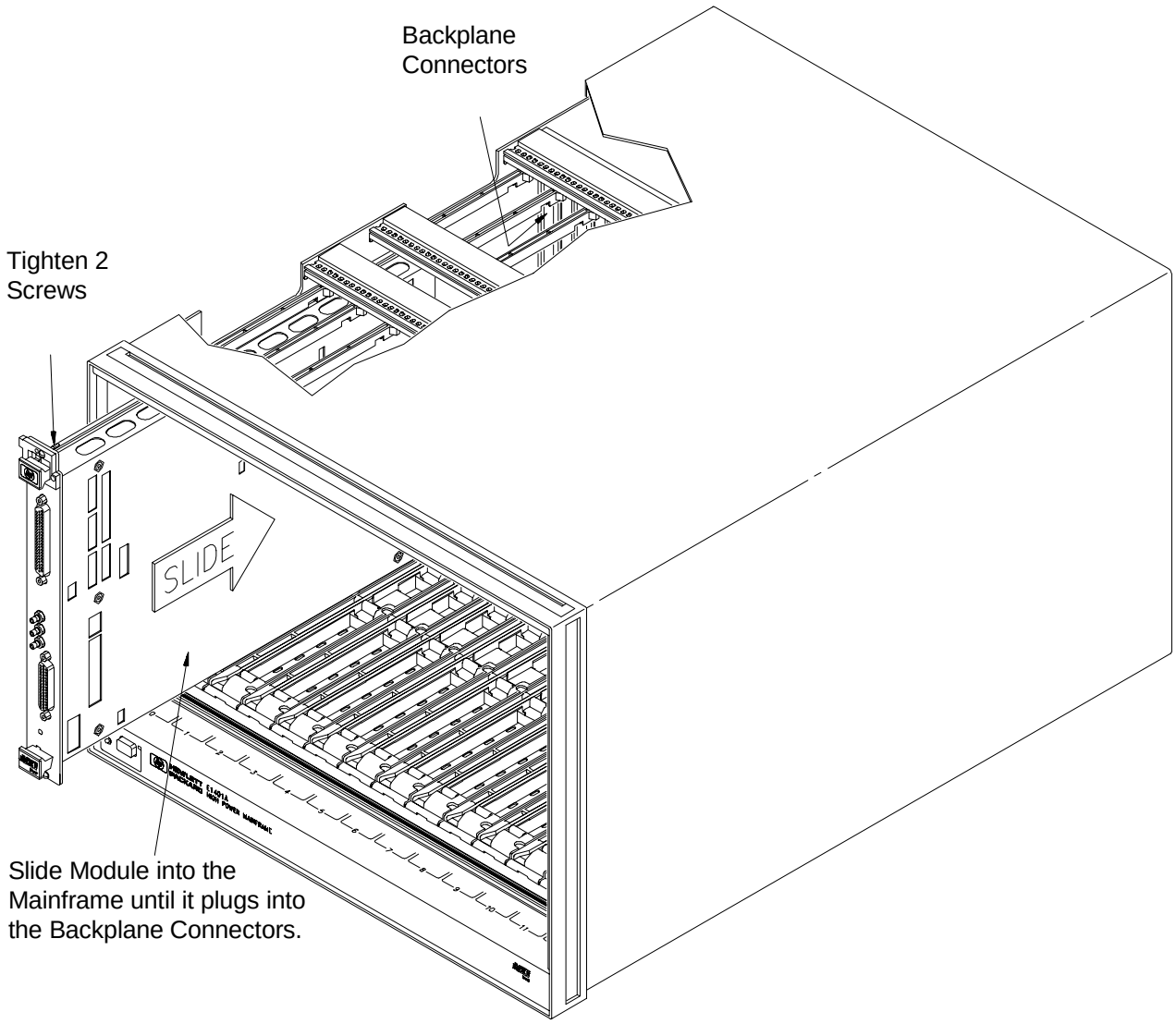


Figure 3-22. Installing Modules

MXIbus-7 : Connect Interface Cables

NOTE *If you are using an EPC7 embedded computer or an external computer with an EISA/ISA to MXIbus interface card, the VXI-MXI module in mainframe 1 needs to be installed in slot 0 (and configured as a slot 0 device). The EPC7 will then be installed in slots 1 and 2.*

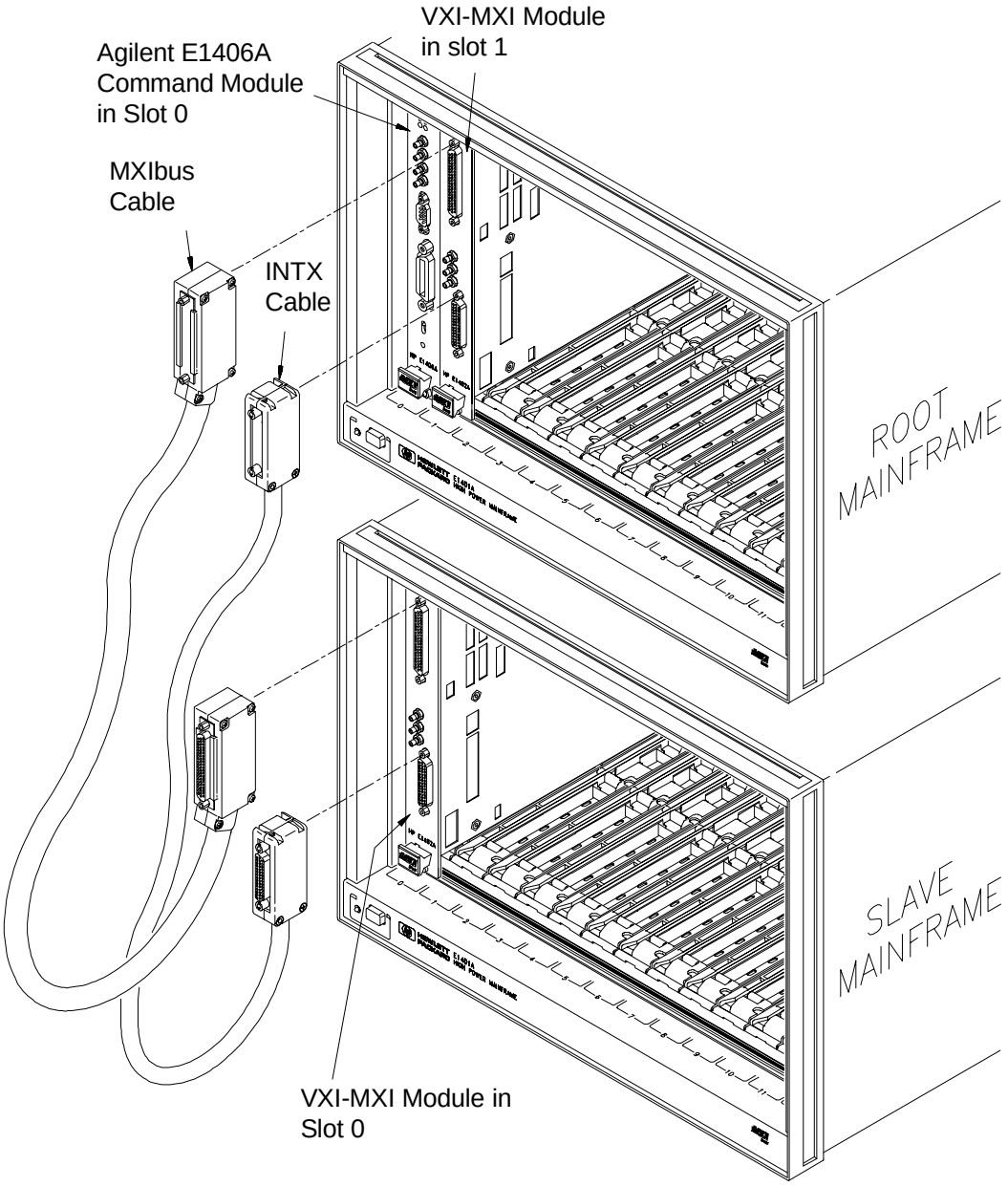


Figure 3-23. Connecting Multiple Mainframes

MXIbus-8 : Apply Power

Once you have installed your MXIbus system, you can apply power by pressing the button in the lower left corner of the mainframe. There are several ways you can confirm installation. However, the method used depends on what type of system controller you are using.

Turn the mainframe's power on and check the system configuration with the examples shown in **Procedure 5 : Apply Power** later in this guide. Confirm installation by checking the card address and slot location.

MXIbus-9 : Where To Go Next

So far you should have done the following:

- Set up the VXI-MXI modules for slot 0 and non-slot 0 operation
- Removed terminating networks from the middle VXI-MXI modules
- Set the VXI-MXI module logical address
- Disable VMEbus Timeout on other devices
- Installed the VXI-MXI Modules
- Connected Interface Cables
- Applied Power and confirmed installation

Once you have completed these steps, continue with the following procedure:

- **"Procedure 4: Configure and Install Instruments"**

Procedure 4: Configure and Install Instruments

This procedure describes how to configure and install VXI modules into your Agilent 75000 Series C VXIbus System. The procedure consists of the following steps:

- Step-1 : Download Instrument Drivers
- Step-2 : Set Instrument Logical Addresses
- Step-3 : Install A- and B-Size Modules With a Module Carrier
- Step-4 : Install C-Size Modules
- Step-5 : Install a Chassis Shield
- Step-6 : Install Backplane Connector Shields
- Step-7 : Install Faceplate Panels
- Step-8 : Where To Go Next

WARNING **SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the system. Before you perform any procedures in this guide, disconnect AC power and field wiring from the mainframe.**

To avoid electrical shock, always cover unused slots with the faceplate panels that came with the mainframe.

CAUTION **STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, observe anti-static techniques whenever handling a module.**

CAUTION **It is your responsibility to ensure adequate cooling is supplied to all modules installed in the mainframe. Section B.7.2.4 of the VXIbus Specification (Revision 1.3) discusses module cooling requirements. Section B.7.3.5 discusses mainframe cooling requirements.**

NOTE *When installing VME devices in the Agilent 75000 Series C mainframe, the devices must not be in conflict with the A24/A32 addresses allocated by the Command Module when functioning as the resource manager. Refer to the Agilent E1406 user's manual for information on A24/A32 address mapping.*

Step-1 : Download Instrument Drivers

If your system contains an Agilent E1406 Command Module and register-based instruments, it may be necessary to download instrument drivers into the Command module. The easiest way to download drivers is to use Agilent VIC or the driver download utility that is included with Agilent VIC.

Instrument drivers enable Agilent Technologies register-based modules to be programmed using SCPI commands. Several instrument drivers are factory installed (Table 4-1). Drivers which are not factory installed ship with the register-based instrument. If you have an instrument that is not listed in the table, then you will need to download the driver.

Table 4-1. E1406A Factory-Installed Drivers

Register-Based Device Model Number	Device Description
Agilent E1326B/E1411B	5 1/2-Digit Multimeters
Agilent E1328A	4-Channel D/A Converter
Agilent E1330B	Quad 8-Bit Digital Input/Output
Agilent E1332A	4-Channel Counter/Totalizer
Agilent E1333A	3-Channel Universal Counter
Switch Cards	Multiplexers, Matrix, General Purpose

If you do not have Agilent VIC or the download utility, instructions for downloading the drivers are contained in the "Downloading Device Drivers Installation Note" (p/n E1401-90021).

The installation and configuration procedures discussed in this manual apply to the factory-installed drivers. If a driver is not installed, the resource manager will report the following message at the end of the power-on sequence:

WARNING: DEVICE DRIVER NOT FOUND

Step-2 : Set Instrument Logical Addresses

All instruments are shipped with a factory-set logical address. In some cases you can use the factory-set logical address. The following table lists selected Agilent instruments and their factory-set logical addresses:

Table 4-2. Factory-Set Logical Addresses

Agilent Instruments	Logical Address	Agilent Instrument	Logical Address
Digital Multimeters Agilent E1326B/E1411B	24	Multiplexers Agilent E13xx Multiplexers Agilent E14xx Multiplexers	112
Digitizers Agilent E1426A, E1428A Agilent E1429A/B	40	Other Switches Agilent E13xx, E14xx Matrix Agilent E13xx, E14xx RF Agilent E13xx, E14xx Form C Agilent E13xx, E14xx General Purpose	120
Counters Agilent E1420B, E1332A, E1333A	48	Digital Functions Test Agilent Model D20	136
Power Meters Agilent E1416A	56	Digital Input / Output Agilent E1330B	144
Arbitrary Waveform Generators Agilent E1340A, E1445A	80	Agilent Instrument BASIC	240

Notice that some cards have the same logical address. When installing cards into a mainframe, however, each card must have a unique logical address. Thus, if you have cards with the same factory-set logical address, you must change the logical address on some of the cards.

Use the following steps to set an instrument's logical address:

1. Locate the logical address switch on the card. Figure 4-1 shows the switch locations for most B- and C-Size modules.
2. Set the card's logical address using the following rules:
   - First, try to use the factory-set logical address. If you have modules with the same factory-set logical address, change the address of the modules until all modules have different logical addresses.
   - If you have multiple mainframes connected via MXIbus, make sure the logical addresses of the modules in a mainframe are within the logical address window for that mainframe. See "MXIbus-4 : Set the VXI-MXI Module's Logical Address" in procedure 3.

– Valid logical addresses are 1 through 255. Most Agilent modules are statically configured modules, which means that you have to physically set the address on the switch. To dynamically configure a module which supports dynamic configuration, its logical address must be set to 255. A dynamically configured module's address is set programmatically by the resource manager. Note, however, if a statically configured module is set to 255, the resource manager will not dynamically configure any module.

For Agilent E1406 Command Module Only

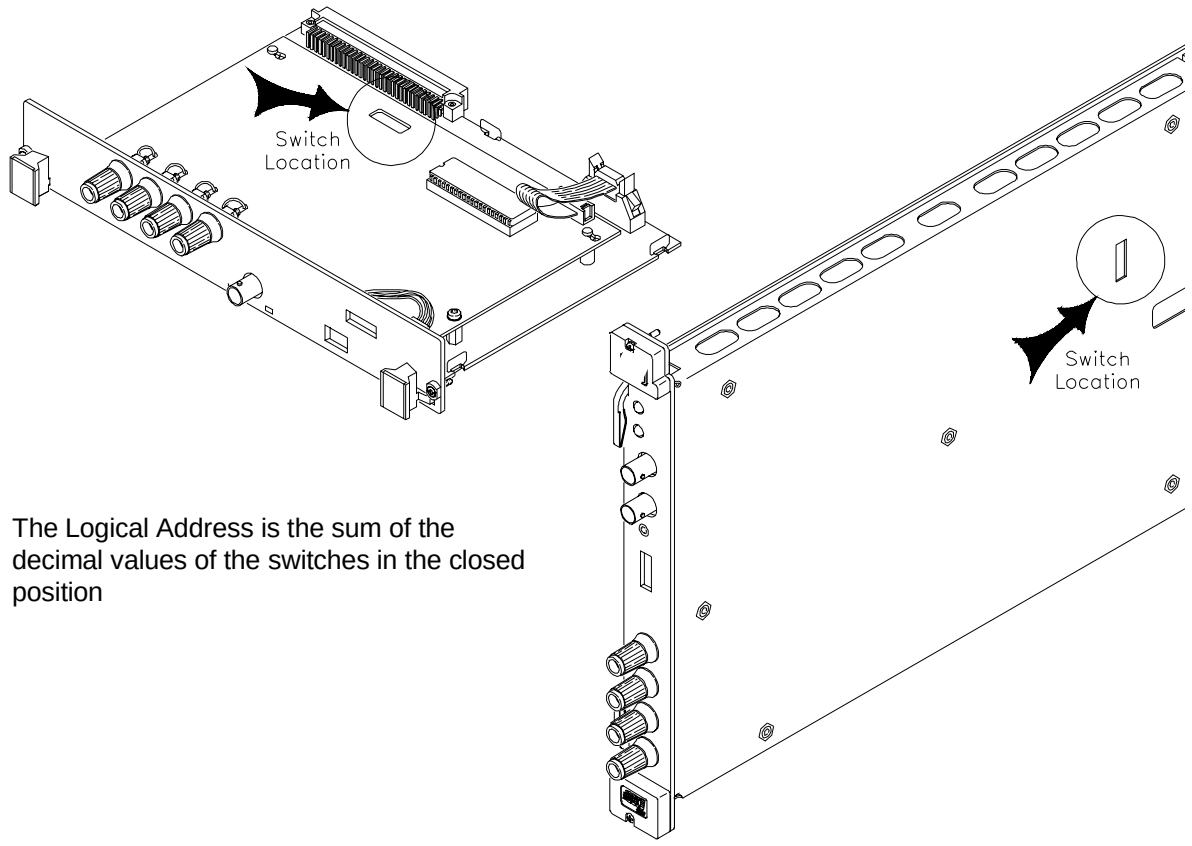
– Each instrument must have one plug-in module assigned as an **Instrument Identifier**. The Instrument Identifier is the module with its logical address set to a multiple of 8, such as 8, 16, or 24.

– An instrument consisting of multiple modules is called a **virtual instrument**. The modules of the virtual instrument must be assigned successive logical addresses beginning with the address of the Instrument Identifier. For example, to create a scanning multimeter virtual instrument which consists of a multimeter and two multiplexers, the logical addresses could be set to:

24 (multimeter)
25 (1st multiplexer)
26 (2nd multiplexer)

Note, however, you *cannot* combine multiple modules of the same type (like multiple multimeters or multiple counters) into virtual instruments.

– A plug-in module with a logical address that is not a multiple of 8, or that is not part of a virtual instrument, is an unassigned module. Such modules must be programmed at the register level, rather than with SCPI commands. (A secondary GPIB address can be given to an unassigned module with the Command Module's User-Defined Commander/Servant Hierarchy table (see the Agilent E1406 User's Manual).)

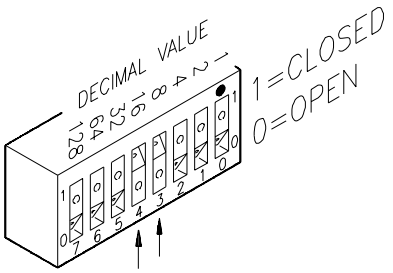


The Logical Address is the sum of the decimal values of the switches in the closed position

Figure 4-1. Setting a Logical Address

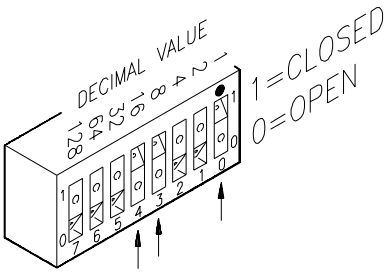
Table 4-3. Typical Logical Addresses

LADDR = 24



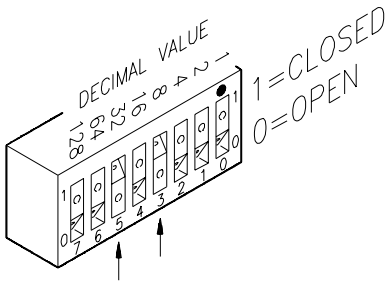
16 + 8 = 24

LADDR = 25



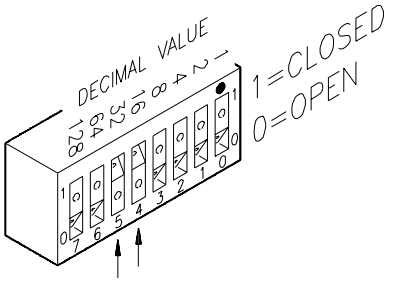
16 + 8 + 1 = 25

LADDR = 40



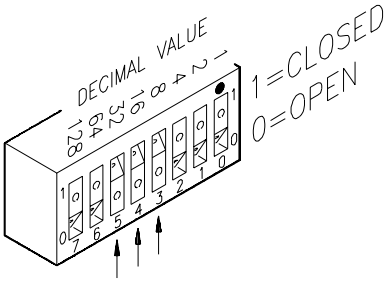
32 + 8 = 40

LADDR = 48



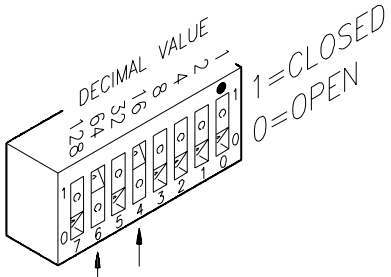
32 + 16 = 48

LADDR = 56



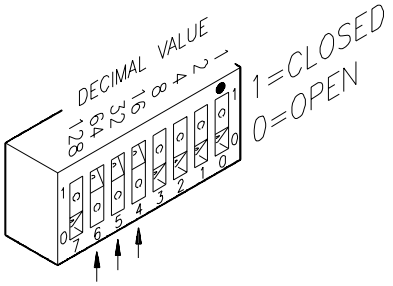
32 + 16 + 8 = 56

LADDR = 80



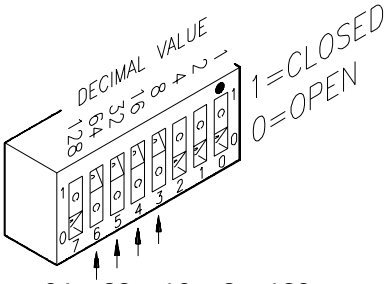
64 + 16 = 80

LADDR = 112



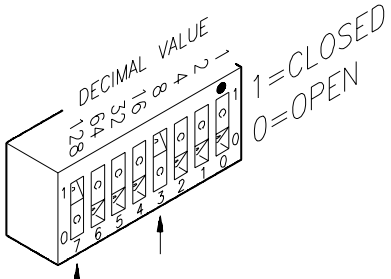
64 + 32 + 16 = 112

LADDR = 120



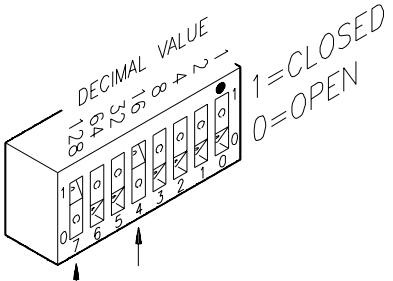
64 + 32 + 16 + 8 = 120

LADDR = 136



128 + 8 = 136

LADDR = 144



128 + 16 = 144

Step-3 : Install A- and B-Size Modules

If you are installing A- or B-Size modules and C-Size modules in the same mainframe, we recommend you install the A- and B-Size modules *first*. (You will generally need more working room to install the smaller modules.) Use Figure 4-2 or 4-3 and the following steps to install A- and B-Size modules:

1. **If the mainframe is turned on, turn the mainframe off by pressing the button in the lower left corner of the mainframe.**

2. Install the Agilent E1403 A/B-size Module Carrier or the Agilent E1407 A/B-size Module Carrier into the mainframe. This is done by aligning the top and bottom of the carrier with the card guides and slowly pushing the carrier into the mainframe. The front of the carrier should be even with the front edges of the mainframe.

   When installing the carrier in the Agilent E1421 mainframe, the "top" of the carrier will be on the left when it is installed horizontally.

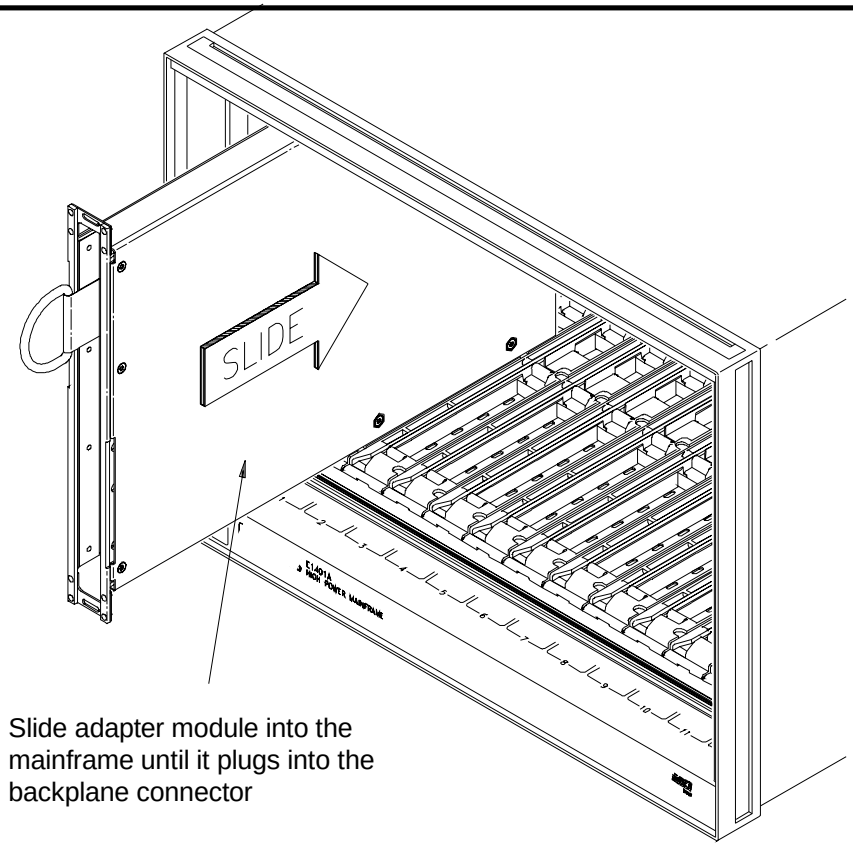
3. Slide the A- or B-Size module into the module carrier until it connects.

4. Tighten the retaining screws on the top and bottomof the module.

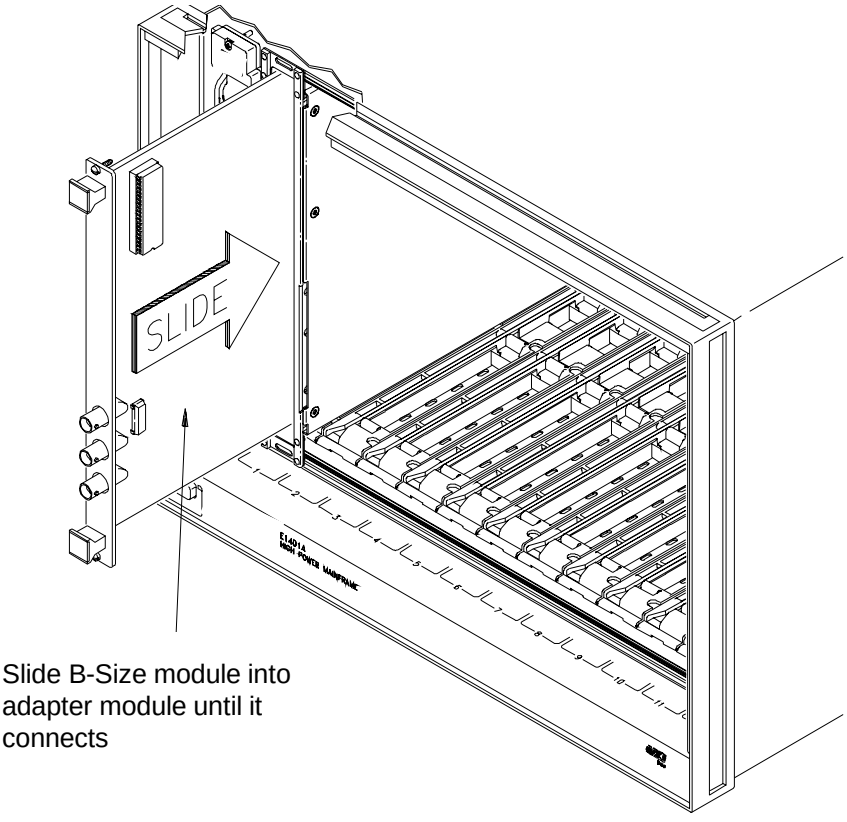
Installation manuals are shipped with each carrier described.

- **Agilent E1403B A/B-size Module Carrier** extends the P1 connector on the VXIbus backplane and mounts the (A/B-size) modules flush with other C-size modules. This carrier is recommended for all Agilent Technologies B-size modules which have only the P1 connector.

- **Agilent E1407A A/B Module Carrier** extends the P1 and P2 connectors on the VXIbus backplane. This carrier is recommended for B-Size modules which have the P1/P2 connectors.



Slide adapter module into the mainframe until it plugs into the backplane connector



Slide B-Size module into adapter module until it connects

Figure 4-2. Installing B-Size Module

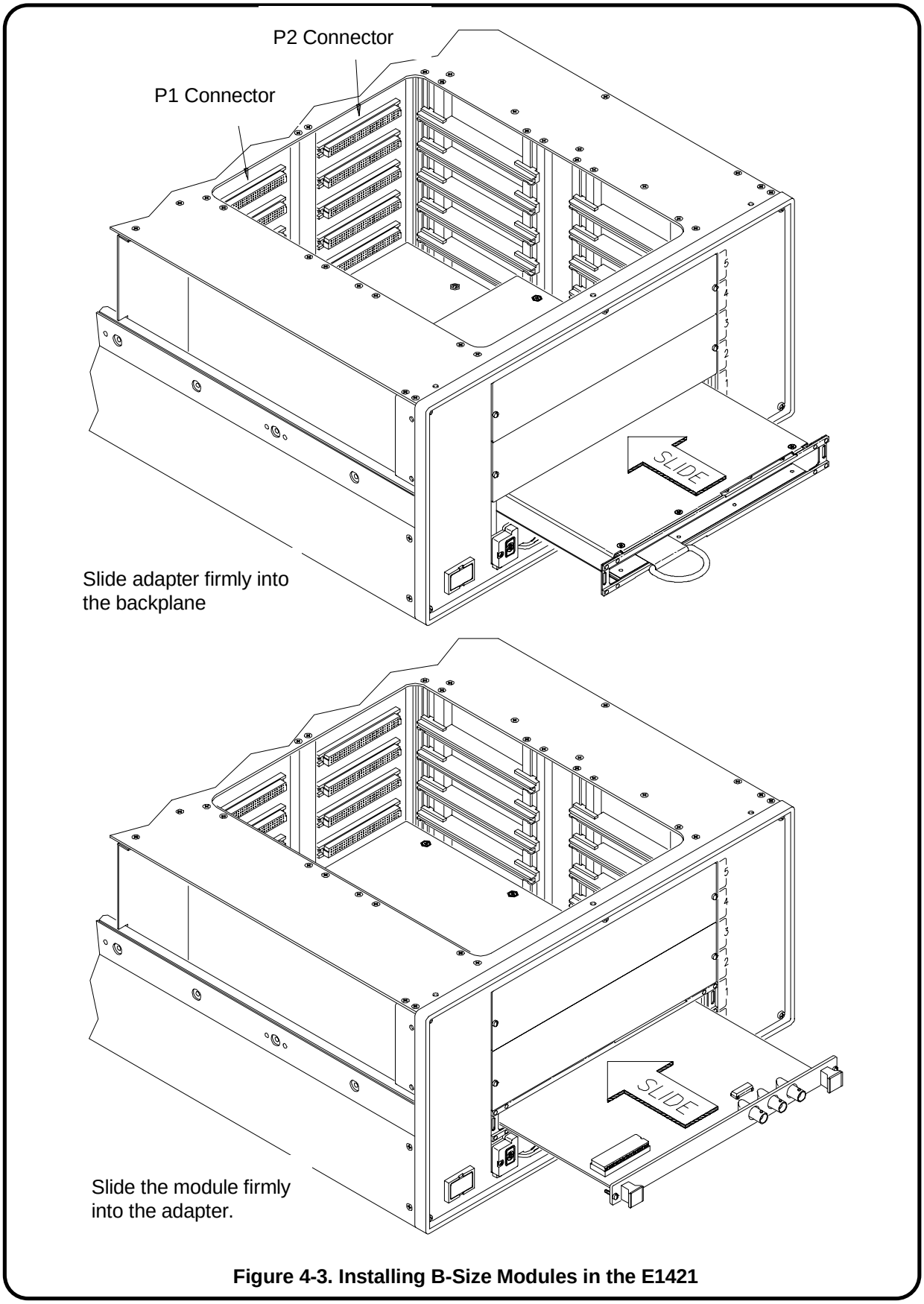


Figure 4-3. Installing B-Size Modules in the E1421

Step-4 : Install C-Size Modules

C-Size Modules can be installed in any slot except slot 0, and need not be installed in adjacent slots. However, when installing multiple modules which make a virtual instrument, the modules should be installed in adjacent slots. This allows cables to be easily connected between the modules. When installing a virtual instrument such as a scanning multimeter, install the multimeter to the left of the multiplexers, which are then installed in adjacent slots to the right.

Use Figure 4-4 or 4-5 and the the following steps to install C-Size modules:

1. **If the mainframe is turned on, turn the mainframe off by pressing the button in the lower left corner of the mainframe.**
2. Insert the module into the mainframe by aligning the top and bottom of the module with the card guides inside the mainframe. Slowly push the module straight into the slot until it seats in the backplane connectors. The front panel of the module should be even with the front edges of the mainframe.

   When installing the module in the Agilent E1421 mainframe, the "top" of the module will be on the left when it is installed horizontally.
3. Tighten the retaining screws on the top and bottom of the module.

NOTE *If the module fails to insert properly, make sure you are lined up in the card guides and make sure the tabs are turned towards the center of the card.*

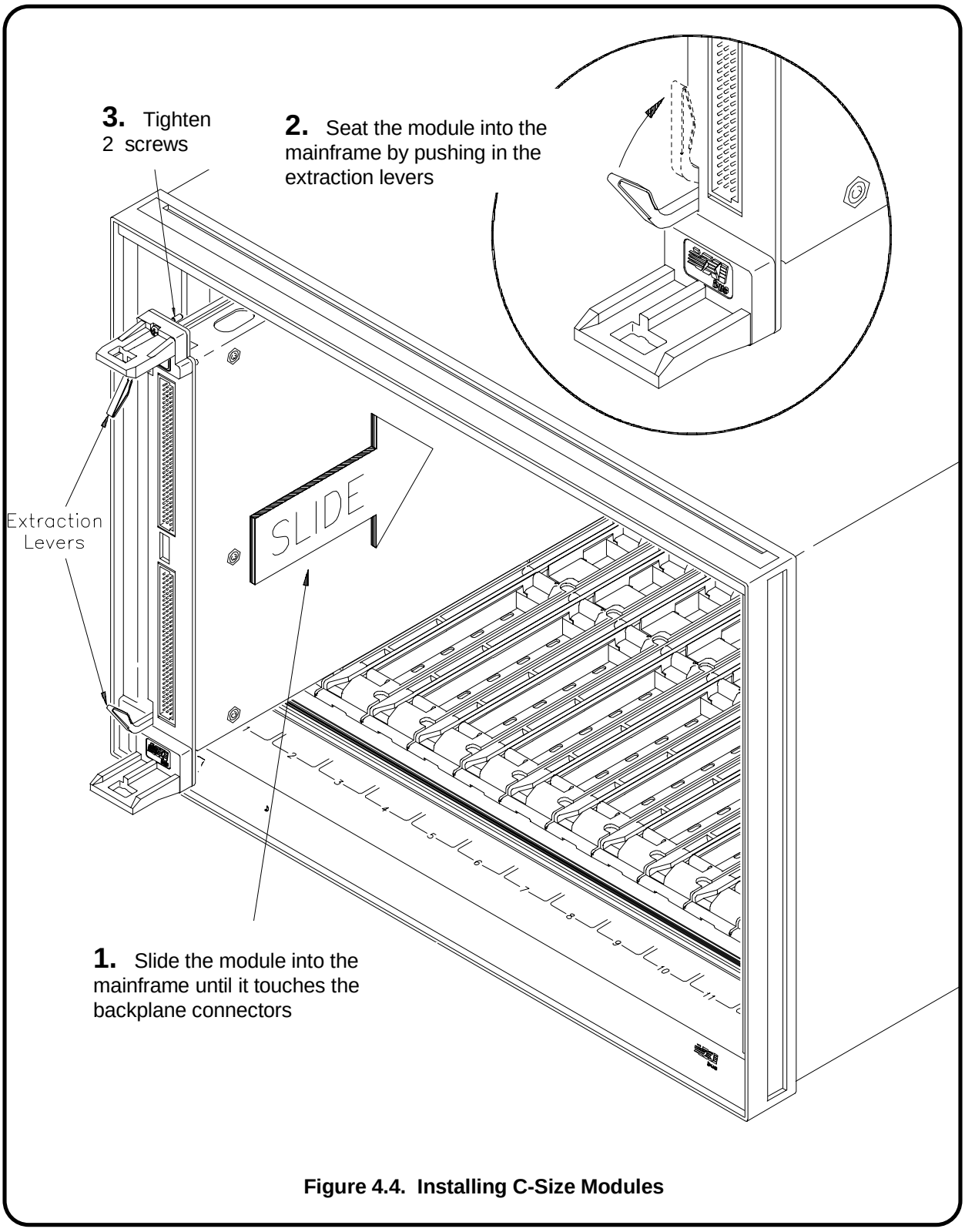

3. Tighten 2 screws
2. Seat the module into the mainframe by pushing in the extraction levers
Extraction Levers
SLIDE
1. Slide the module into the mainframe until it touches the backplane connectors

Figure 4.4. Installing C-Size Modules

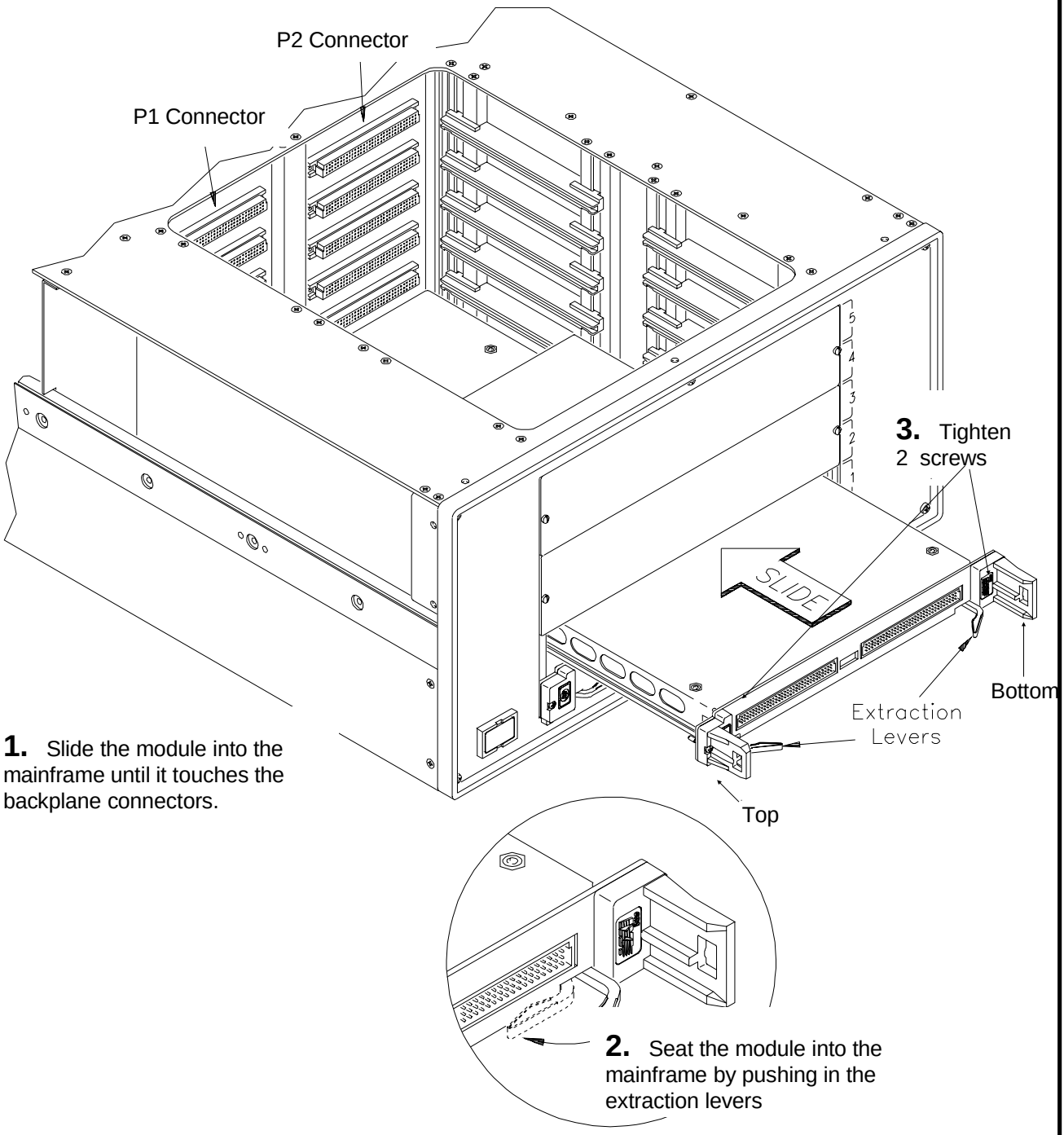

P2 Connector
P1 Connector
3. Tighten 2 screws
SLIDE
Bottom
Extraction Levers
Top
1. Slide the module into the mainframe until it touches the backplane connectors.
2. Seat the module into the mainframe by pushing in the extraction levers

Figure 4-5. Installing C-Size Modules in the E1421

Step-5 : Install a Chassis Shield

If EMI shielding is needed, install the Agilent E1409A/B Chassis Shield according to the instructions in the *Agilent E1409A/B Installation Manual*.

This shield is the Agilent Technologies implementation of Section B.7.3.4 of the VXIbus Specification (Revision 1.3) that allows grounded shielding between mainframe slots. Typical applications for the chassis shield include isolating modules that generate electro-magnetic interference (EMI) at excessive levels, and shielding modules from noise sources during sensitive measurements.

The chassis shield assembly contains a plated-steel shield with four conductive chassis shield guides and mounting hardware. Two adhesive-backed thermoplastic insulators are also included and can be attached to the chassis shield if desired. Since the chassis shield fits *between* slots in the mainframe, you do not lose the use of a slot by installing the shield.

Step-6 : Install Backplane Connector Shields

For conformance with the following European EMC Standards:

CISPR 11:1990/EN 55011 (1991): Group 1 Class A
IEC 801-2:1991/EN 50082-1 (1992): 4 kVCD, 8 kVAD
IEC 801-3:1984/EN 50082-1 (1992): 3 V/m
IEC 801-4:1988/EN 50082-1 (1992): 1 kV

Some Agilent VXI modules ship with a backplane connector shield kit. This kit includes:

Quantity	Description	Part Number
2	connector shields	E1400-80601
4	TORX screws	0624-0702

If you have a module which shipped with this kit and which must conform to these standards, install the shields as shown in Figure 4-6. On the Agilent E1401A mainframe, it may be necessary to temporarily remove the plastic slot guide in order to install the bottom screw on the bottom shield.

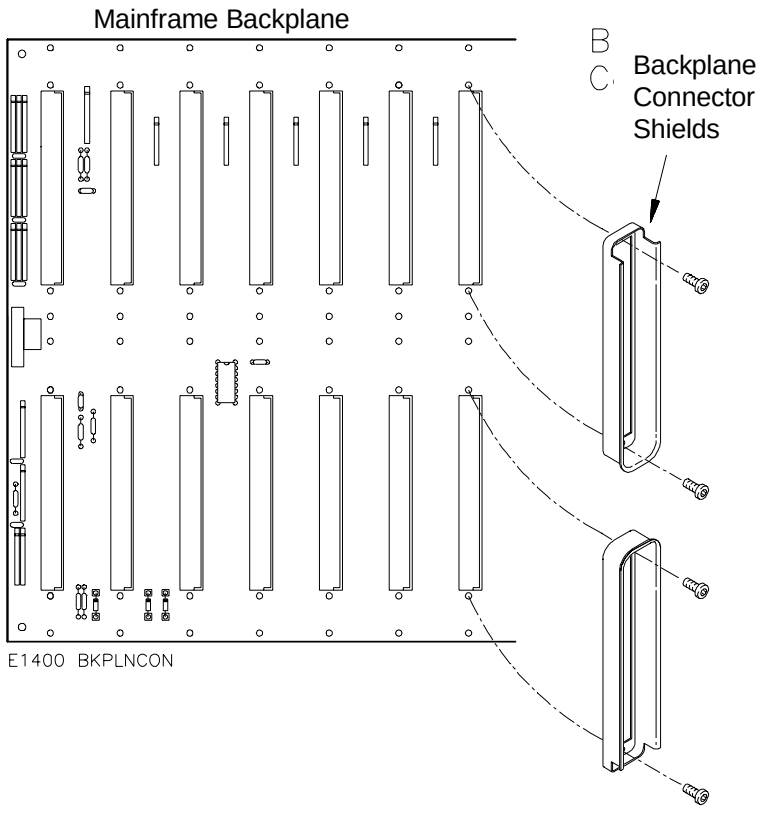


Figure 4-6. Installing the Backplane Connector Shields

Step-7 : Install Faceplate Panels

The Agilent E1401 and Agilent E1421 mainframes are shipped from the factory with faceplate panels installed to cover the module slots. *To avoid electrical shock, always cover unused slots with the faceplate panels.*

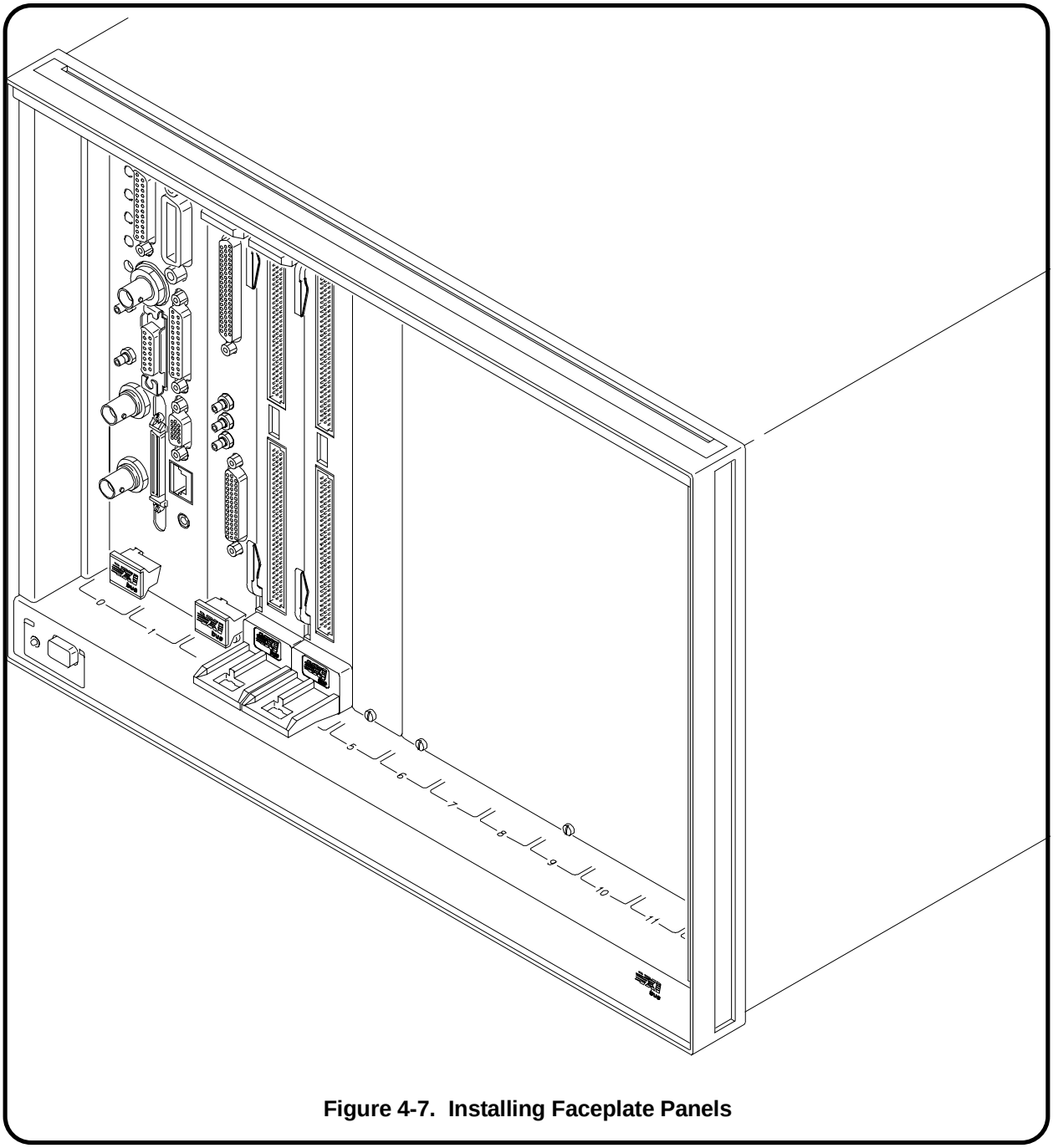


Figure 4-7. Installing Faceplate Panels

Step-8 : Where To Go Next

So far you should have done the following:

- Downloaded device drivers (with Command Module Only)
- Set the instrument logical addresses
- Installed A-, B-, and C-size modules
- Installed chassis shield (optional)
- Installed faceplate panels

Once you have installed all your VXI modules, continue with the following procedure:

- **Procedure 5 : Apply Power**

Procedure 5: Apply Power

Once the controller to VXI mainframe interface has been set up and modules have been installed, power can be applied to the system again. This section covers the power-on sequences of the following controller-based VXIbus systems:

- Agilent E1406 Command Module with an External Computer
- HP 9000 Series 700 Computer
- Agilent E1497A/E1498A Embedded V743 Controller
- Agilent RADI-EPC7 Embedded 486 Computer

Power is applied by pressing the mainframe's power switch. At power-on, the installed modules begin their self-test routines and the system resource manager begins its configuration sequence. If a plug-in module fails its self test, the device is taken off-line by the system's resource manager and is excluded from the configuration process.

Agilent E1406 Command Module with an External Computer

In a system controlled by an external computer, the Agilent E1406A Command Module is often the system's resource manager. An example of the E1406A's power-on and configuration sequence is shown in Figure 5-1. This sequence can be monitored on an RS-232 terminal or printer connected to the Command Module's RS-232 serial interface port. Pressing CTRL S on the terminal keyboard pauses the sequence. Pressing CTRL Q allows the sequence to resume. Note that once the sequence is paused, it remains paused until CTRL Q is pressed.

NOTE *The Agilent E1406 Command Module's **Flash ROM** switch must be set to the 'Run' position when the Command Module is turned on.*

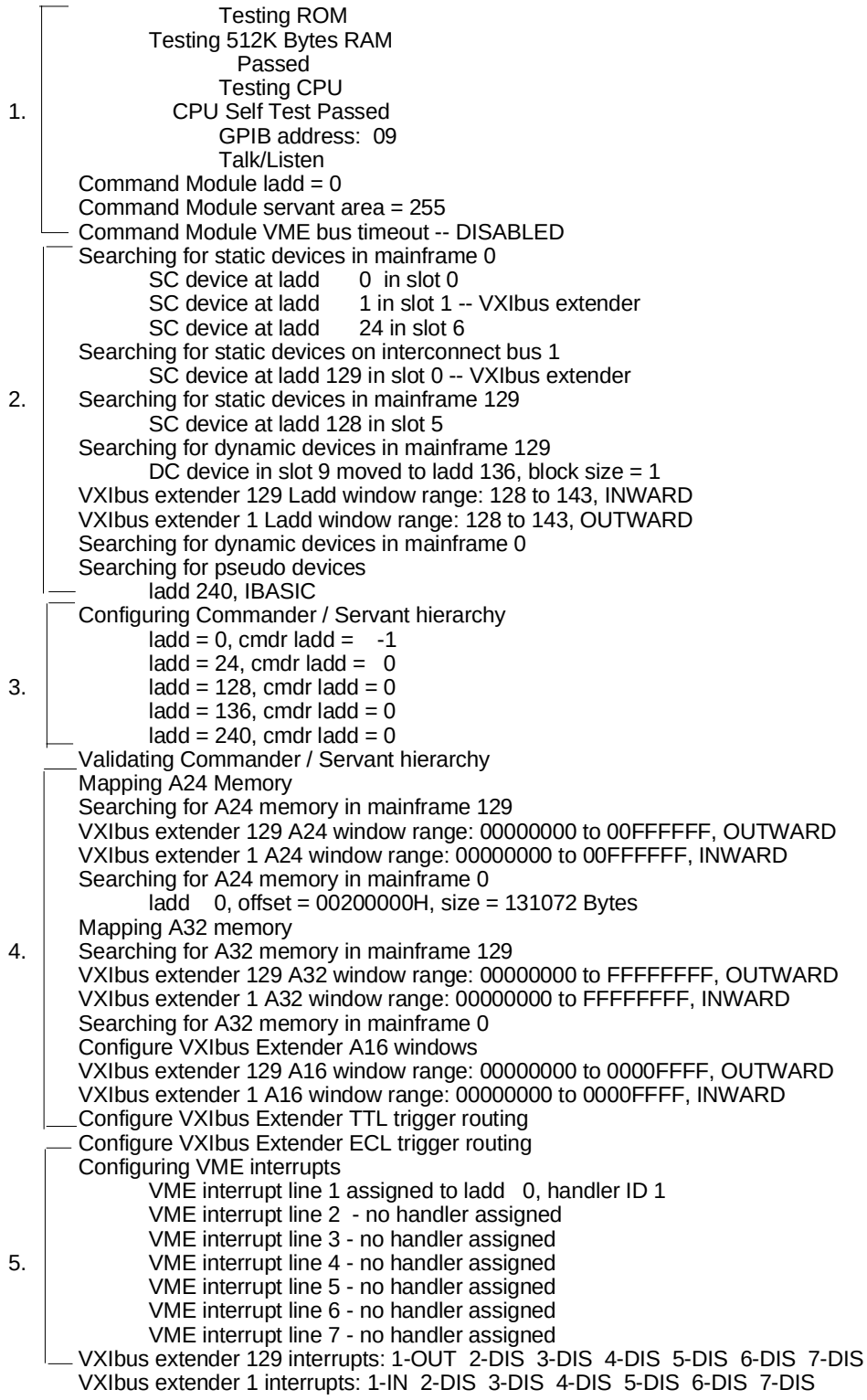

Testing ROM
Testing 512K Bytes RAM
Passed
Testing CPU
1. CPU Self Test Passed
GPIB address: 09
Talk/Listen
Command Module ladd = 0
Command Module servant area = 255
Command Module VME bus timeout -- DISABLED
Searching for static devices in mainframe 0
SC device at ladd 0 in slot 0
SC device at ladd 1 in slot 1 -- VXIbus extender
SC device at ladd 24 in slot 6
Searching for static devices on interconnect bus 1
SC device at ladd 129 in slot 0 -- VXIbus extender
2. Searching for static devices in mainframe 129
SC device at ladd 128 in slot 5
Searching for dynamic devices in mainframe 129
DC device in slot 9 moved to ladd 136, block size = 1
VXIbus extender 129 Ladd window range: 128 to 143, INWARD
VXIbus extender 1 Ladd window range: 128 to 143, OUTWARD
Searching for dynamic devices in mainframe 0
Searching for pseudo devices
ladd 240, IBASIC
Configuring Commander / Servant hierarchy
ladd = 0, cmdr ladd = -1
ladd = 24, cmdr ladd = 0
3. ladd = 128, cmdr ladd = 0
ladd = 136, cmdr ladd = 0
ladd = 240, cmdr ladd = 0
Validating Commander / Servant hierarchy
Mapping A24 Memory
Searching for A24 memory in mainframe 129
VXIbus extender 129 A24 window range: 00000000 to 00FFFFFF, OUTWARD
VXIbus extender 1 A24 window range: 00000000 to 00FFFFFF, INWARD
Searching for A24 memory in mainframe 0
ladd 0, offset = 00200000H, size = 131072 Bytes
Mapping A32 memory
4. Searching for A32 memory in mainframe 129
VXIbus extender 129 A32 window range: 00000000 to FFFFFFFF, OUTWARD
VXIbus extender 1 A32 window range: 00000000 to FFFFFFFF, INWARD
Searching for A32 memory in mainframe 0
Configure VXIbus Extender A16 windows
VXIbus extender 129 A16 window range: 00000000 to 0000FFFF, OUTWARD
VXIbus extender 1 A16 window range: 00000000 to 0000FFFF, INWARD
Configure VXIbus Extender TTL trigger routing
Configure VXIbus Extender ECL trigger routing
Configuring VME interrupts
VME interrupt line 1 assigned to ladd 0, handler ID 1
VME interrupt line 2 - no handler assigned
VME interrupt line 3 - no handler assigned
5. VME interrupt line 4 - no handler assigned
VME interrupt line 5 - no handler assigned
VME interrupt line 6 - no handler assigned
VME interrupt line 7 - no handler assigned
VXIbus extender 129 interrupts: 1-OUT 2-DIS 3-DIS 4-DIS 5-DIS 6-DIS 7-DIS
VXIbus extender 1 interrupts: 1-IN 2-DIS 3-DIS 4-DIS 5-DIS 6-DIS 7-DIS

Figure 5-1. Command Module Resource Manager Configuration Sequence

SYSTEM INSTALLED AT SECONDARY ADDR 0
VOLTMTR INSTALLED AT SECONDARY ADDR 3
MBinstr INSTALLED AT SECONDARY ADDR 17
MBinstr INSTALLED AT SECONDARY ADDR 18
IBASIC INSTALLED AT SECONDARY ADDR 30
IBASIC memory: 115232
6. SYSTEM instrument started
File System memory: 40131
File System Started
BNO issued to ladd 136, BNO response = FFFE
Opening GPIB/IBASIC access for message based device at sec addr 17
BNO issued to ladd 144, BNO response = FFFE
Opening GPIB/IBASIC access for message based device at sec addr 18

1. The Agilent E1406 operating system performs a series of self-tests and clears its volatile RAM. The Command Module's GPIB address, logical address, servant area, and VME (data transfer) bus timer functionality are reported. You must disable the VME bus timer when Agilent E1482A VXI-MXI mainframe extender modules are part of your system.

2. For each mainframe, the resource manager locates all statically configured modules, locates and configures all dynamically configurable modules, and then locates pseudo devices such as IBASIC. The VXI-MXI extender outward and inward logical address windows are then opened.

3. The resource manager establishes the VXIbus system's commander/servant hierarchies based on the commander's servant area and the servant's logical address.The Command Module in this configuration is the top-level commander, and as such, is not a servant to another commander (cmdr ladd = -1).

4. The resource manager allocates A24 and A32 addresses for those modules' memory requirements. Note that the offset is specified in hexadecimal and the size is specified in bytes. A24 and A32 address space is opened up to modules accessed through the VXI-MXI mainframe extender modules.

5. The resource manager allocates interrupt lines to all interrupt handlers in the system. Agilent Technologies register-based modules have their interrupt line jumper set to '1' at the factory. In systems with multiple Command Modules the other interrupt lines are assigned. Modules controlled by those Command Modules must have their jumpers moved accordingly. Interrupt line '1' is enabled to route interrupts OUT from mainframe 137 to the handler in mainframe 0. Interrupt line '1' is enabled to route interrupts IN to the interrupt handler in mainframe 0 (VXIbus extender 2). All other interrupt routing lines are disabled since there are no other interrupt handlers.

6. The resource manager identifies the secondary GPIB addresses in the system, starts the system instrument (i.e. Command Module), issues the Begin Normal Operation (BNO) command to its message based servants and opens GPIB access to those modules.

Figure 5-1. Command Module Resource Manager Configuration Sequence (Cont'd)

Configuration and Start-Up Errors

If the Command Module fails its self test, the "Failed" annunciator lights up on the faceplate. Should this occur:

- Turn the mainframe off, remove the Command Module, check the configuration switches (i.e. logical address, slot 0/system controller enable).
- If it still fails, turn the mainframe off, remove all other installed modules. Apply power, and if the Command Module passes its self test, add the other plug-in modules one at a time - cycling power each time.

- if necessary, call your nearest Agilent Technologies sales and service office.

When using the Command Module for the first time or when the mainframe has not been turned on for at least one week, leave the mainframe on for at least 15 hours to fully charge the Command Module's battery.

If a configuration or start-up error such as an invalid address or failed self test occurs, the error is reported in the power-on and configuration sequence. A list of the configuration and start-up error messages and their causes can be found at the end of this guide.

HP 9000 Series 700 Computer

To verify that the E1482B VXIbus extender module, the MXIbus and INTX cables, and all VXI instruments are correctly installed, turn on the mainframe. This starts the system resource manager function (ivxirm) provided by the Agilent E1489I MXIbus Controller Interface card and the Agilent E2093B SICL software. To view the contents of the configuration file (rsrcmgr.out) written to by the resource manager, type the following command:

/usr/pil/bin/ivxisc

An example of a configuration file (sequence) is shown in Figure 5-2.

```
VXI Current Configuration:
MXI BUS: 0
        Device Logical Addresses: 0   2   24   128

Slots:                  0   1   2   3   4   5   6   7   8   9   10  11  12
                        --  --  --  --  --  --  --  --  --  --  --  --  --
Empty                       0   0   0   0       0   0   0   0    0   0   0
Single  Device          X                   X
Multiple Devices
VME
Failed

VXI Device Table:

Name          LADD  Slot    Bus       Manufacturer          Model
---------     ----- ------  ------    --------------------  ----------
hpmxictlr       0     *       0       Hewlett Packard       0x8fd
hpvximxi        1     *       0       Hewlett Packard       0xfe
dev1           24     3       128     Hewlett Packard       E1411 DMM
relaymux       25     4       128     Hewlett Packard       E1460 64 ch. 2W relay mux/matrix
hpvximxi2      128    *       0       Hewlett Packard       0xfe

* - MXI device

VME Device Table:

Name          Bus     Slot    Space     Size
--------      -----   -----   ---------  ------
No VME cards configured.

Failed Devices:

Name          Bus     Slot    Manufacturer          Model
---------     -----   -----   --------------------  ----------
No FAILED devices detected.

Protocol Support (Msg Based Devices):

Name          CMDR  SIG  MSTR  INT  FHS  SMP  RG  EG  ERR  PI  PH  TRG  I4  I  LW  ELW  1.3
--------      ---------  -----  ---------  -----  -----  ------  ----  ----  ------  ---  ----  ------  --  --  ---  -----  ----
hpmxictlr       X       X  X                          X          X       X                       X

Commander/Servant Hierarchy:
hpmxictlr
        dev1
        relaymux
hpvximxi
hpvximxi2

Memory Map;

A24                     Device Name
-----                   --------------------
0x200000 - 0x2fffffff   hpmxictlr

A32                     Device Name
-----                   --------------------
No devices mapped into A32 space.
```

Figure 5-2. E1489I/E2093B Configuration Sequence (output of "ivxisc")

```
Interrupt Request Lines:
                    Handler       Interrupter
Name            1 2 3 4 5 6 7   1 2 3 4 5 6 7
---------       -------------------------------------
hpmxictlr       X XX X X X X
hpvximxi
dev1
relaymux
hpvximxi2

VXI-MXI IRQ Routing:

Name            1  2  3  4  5  6  7
--------        -  -  -  -  -  -  -
hpvximxi        I  I  I  I  I  I  I
hpvximxi2       O O O  O O  O  O

I - MXI->VXI
O - VXI->MXI
* - Not Routed

VXI-MXI TTL Trigger Routing:

Name            0   1  2  3   4   5   6  7
---------       -   -  -  -   -   -   -  -
hpvximxi        I   I  I  I   I   I   I   I
hpvximxi2       I   I  I  I   I   I   I   I
I - MXI -> VXI
O - VXI -> MXI
* - Not Routed

VXI-MXI Registers:

Name
--------
hpvximxi
  laddr window register: 0x3800 range: 0-255
  a24 window register: disabled
  a32 window register: disabled
  Interrupt Configuration Register: 0xFFFFFFFF
hpvximxi2
  laddr window register: 0x7F18 range: 24-25
  a24 window register: disabled
  a32 window register: disabled
  Interrupt Configuration Register: 0x7F00
```

Figure 5-2. E1489l/E2093B Configuration Sequence (Cont'd)

Agilent E1497A/ E1498A Embedded V743 Controller

To verify that the V743 controller-based system is installed correctly, turn on the mainframe. If configured, this starts the system resource manager (ivxirm) provided by the V743. To view the contents of the configuration file (/usr/pil/etc/vxiLU/rsrcmgr.out) written to by ivxirm, type the following command:

ivxisc /usr/pil/etc/vxi*LU*

Where *LU* is the logical unit number of the VXI interface. An example of the V743 configuration sequence is shown in Figure 5-3.

```
VXI Current Configuration:

VXI BUS: 0
        Device Logical Addresses: 0 24 127    128

Slots:                  0  1  2  3  4  5  6  7  8  9  10 11 12
                        -- -- -- -- -- -- -- -- -- -- -- -- --
Empty                      O  O  O  O  O     O  O     O  O
Single Device           X                          X
Multiple Devices                          X
VME                                                      V
Failed

VXI Device Table:

Name          LADD  Slot   Bus       Manufacturer          Model
---------     ----- ------ ------    --------------------  ----------
v743ctlr          0      0         0  Hewlett Packard       E1497 Series 700 VXI Controller
dmm              24      9         0  Hewlett Packard       E1410 DMM
translator      127      6         0  Hewlett Packard       E1404 Translator Module
msgtrans        128      6         0  Hewlett Packard       E1404 Translator Message Interface

VME Device Table:

Name          Bus    Slot    Space     Size
--------      -----  -----   ---------  ------
memdev            0      12      A24       512K

Failed Devices:

Name          Bus    Slot    Manufacturer          Model
---------     -----  -----   --------------------  ----------
No FAILED devices detected.

Protocol Support (Msg Based Devices):

Name          CMDR  SIG  MSTR   INT   FHS  SMP  RG  EG   ERR  PI  PH  TRG  I4  I  LW  ELW  1.3
--------      ---------  -----  ---------  -----  -----  ------  ----  ----  ------  ---  ----  ------  --  --  ---  -----  ----
v743ctlr          X       X   X                    X          X        X                          X
dmm                               X                    X    X  X                  X   X  X             X
msgtrans                  X   X  X                    X    X  X    X   X    X                  X

Commander/Servant Hierarchy:
v743ctlr
        dmm
        translator
        msgtrans

Memory Map:

A24                     Device Name
-----                   --------------------
0x200000 - 0x27ffff     memdev
0x300000 - 0x3fffff         v743ctrl

A32                     Device Name
-----                   --------------------
No devices mapped into A32 space.
```

Figure 5-3. V743 Configuration Sequence

```
Interrupt Request Lines:

                Handler              Interrupter
Name      1 2 3 4 5 6 7        1 2 3 4 5 6 7
- - - -    - - - - - - -        - - - - - - -
V743ctrl  X   X X X X X
dmm
translator
msgtrans  X                    X
```

Figure 5-3. V743 Configuration Sequence (Cont'd)

Agilent RADI-EPC7 Embedded 486 Computer

When power is applied to the mainframe, the Start-Up Resource Manager (SURM) on the Agilent RADI-EPC will execute. An example of the EPC7 configuration sequence is shown in Figure 5-4.

Use the Pg Up/Pg Dn keys to view the entire configuration. Pay particular attention to the Slot Reporting and ULA (Unique Logical Address). These items will help you confirm a proper installation. Press ESC to exit the EPC7 Start-up Resource Manager.

NOTE *Refer to the EPConnect/VXI for DOS User's Guide for more information on the Agilent RADI-EPC7 resource manager configuration sequence and for information on configuration and start up errors.*

VXI System Configuration

```
- - All Devices - -
NAME                ULA      BUS.SL   MANUFACTURER MODEL          A32/A24 MEMORY
TopCmdr             S000       0.00   RadiSys Corp EPC-7 S0       400000-7FFFFF
vdev0               S024       0.02   Hewlett-Pack Agilent E1411
vdev1               S025       0.03   Hewlett-Pack Agilent E1460

- - Memory Devices - -
NAME                TYPE     SUBTYPE          PRIV   SPEED              BLKT D32

- - Message Devices - -                                                  BNO STATES
NAME                CMD'R    SIGREG    MASTER       INT'R  FASTHS      SHMEM     SELF  SVNTS
TopCmdr               X          X          X            X                X       NA    NA

- - Slot Report - -      root mainframe
                        0  1  2  3  4  5  6  7  8  9  10  11  12
EMPTY/NONVXI               X           X  X  X  X  X  X   X   X   X
OPERATING               X     X  X
NON-OPERATING
INDETERMINATE
VXI 1.3

Commander/Servant Hierarchy
TopCmdr
    |___vdev0
    |___vdev1

- - Interrupt Map - -                                  IRQ
Device Name         Interrupter                  7 6 5 4 3 2 1          Handler
TopCmdr                                                                 [H1]
TopCmdr                                                                 [H2]
TopCmdr                                                                 [H3]
TopCmdr                                                                 [H4]
TopCmdr                                                                 [H5]
TopCmdr                                                                 [H6]
TopCmdr                                                                 [H7]

- - ULA usage and bus traversal map - -
bus     ula
  0     000     TopCmdr
        . . .
  0     024     vdev0
  0     025     vdev1
        . . .
  0     255     *vacant*

- - A24 usage and bus traversal map - -
bus low-high addresses
0   000000-3fffff       *vacant*
0   400000-7fffff       TopCmdr
0   800000-ffffff       *vacant*

- - A32 usage and bus traversal map - -
bus low-high addresses
0   00000000-ffffffff   *vacant*

=== Bottom ===
```

Figure 5-4. RADI-EPC7 Resource Manager Configuration Sence

Setting Commander/Servant Hierarchies when using a Command Module

When you have an EPC7, Command Module, and Agilent register-based instruments to be accessed via GPIB in the same system, you must change the commander/servant hierarchy and interrupt mapping so that selected instruments report to the Command Module instead of the EPC7. Changing the commander/servant hierarchy involves the following:

- Verifying instruments in the database
- Assigning VXI device names
- Assigning Commander/Servant Hierarchy
- Assigning interrupt lines

Each procedure is described in following sections and can be run by opening the **VXI Configurator** icon in the EPConnect Program Group. See the EPC7 documentation for additional information on these procedures.

Verifying Instruments in the Database

1. From Windows, select the **VXI Configurator** icon.
2. Select **Database** and scroll to **Models**.
3. Verify that your instruments are listed in the database. If you need to add an instrument, fill in the data and select the **Add** button. The following is an example of adding an Agilent E1406A :
   - Select **Manufacturer** - Hewlett-Pack
   - Enter **Model** - Agilent E1406A
   - Enter **Model number** - 276 (This is the model code printed on side of the instrument.)
   - Select the **Add** button

   Repeat this step for each instrument that needs to be added to the database.
4. Select **OK** to end.

Assigning VXI Device Names

1. From the **VXI Configurator**, select **Devices** and scroll to **VXI**.
2. Each instrument in your system needs to have a device name assigned. The following in an example of assigning a name to the E1406A Command Module:
   - Enter a device name in the **Name** field - Cmdmod
   - Select the device from the **Manufacturer/Model** menu -

     Hewlett-Pack Agilent E1406 276

   - Clear the **Location** and **Logical address** check boxes.

- Select the **Add** button.

  Repeat this procedure for each VXI instrument in your system.

3. Select **OK** to end.

Assigning Commander/Servant Hierarchy

1. From the **VXI Configurator**, select **VXI Control** and scroll to **Commander hierarchy.**

2. Select the commander (Cmdmod, for example) from the **All known names** box and select the **Add commander** button. The commander added will now be shown in the **Commanders** box.

3. Now, select the commander (Cmdmod, for example) from the **Commanders** box and select the device you want to add as a servant in the **All known names** box. Select the **Add servant** button to add the device as a servant to the commander. (The devices listed in the **All known names** box are the same devices you assigned names in the "Assigning VXI Device Names" section.)

   Repeat this step for each device to add as a servant to the commander.

4. Select **OK** to end.

Assigning Interrupt Lines

1. From the **VXI Configurator**, select **VXI Control** and scroll to **Interrupt mapping**.

2. Select the Commander (Cmdmod, for example) from the **Selected device** box.

3. Clear the **Assign IRQs at runtime** box so that you can assign interrupt lines to the selected commander. Assign the interrupt lines as follows:

   - In the attributes box, assign interrupt line 1 to the commander by placing a 1 under **H 1** in the **Handlers, IRQ number or 0** box**.**
   - Select the **Change** button to change interrupt line assignments.

4. If you now have two commanders assigned to interrupt line 1, select the other commander and change **H1** in the **Handlers, IRQ number or 0** box so that interrupt line 1 is assigned only to the Command Module.

5. Select **OK** to end.

Now you need to rerun the Start-up Resource Manager by exiting Windows and turning the VXI Mainframe Off and then On. Notice the Commander/Servant Hierarchy and interrupt map portions of the EPC7 VXI System Configuration Screen. Verify that the commander/servant hierarchy and interrupt lines have been assigned as intended. See Figure 5-5 for an example.

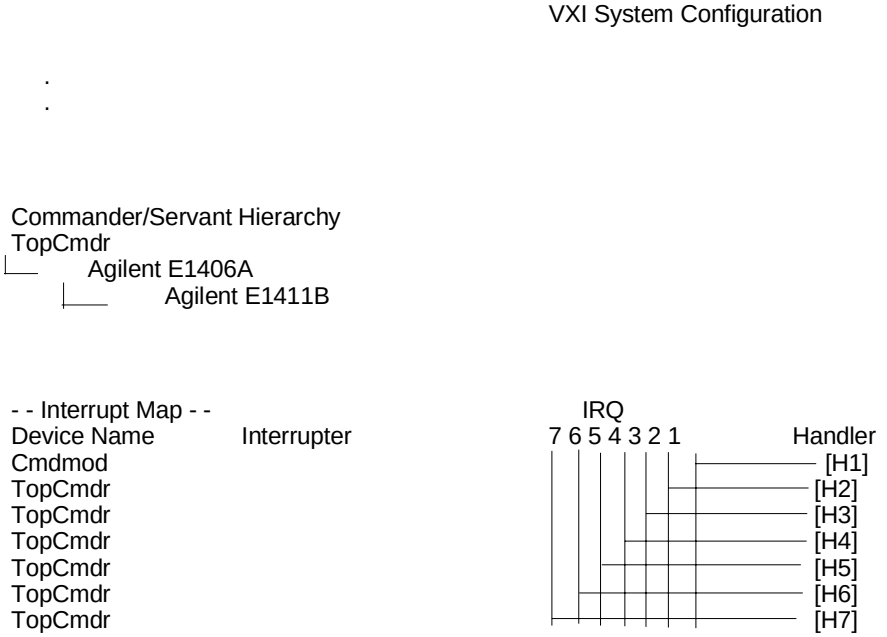


Figure 5-5. Edited RADI-EPC7 Configuration

Where To Go Next

Continue with Procedure 6 - "System Programming and Debugging". This procedure enables you to verify that your computer is communicating with the system, and contains guidelines for debugging your programs.

Procedure 6: System Programming and Debugging

After your instruments have been installed in the VXI mainframe, the next step is to program them. This procedure outlines a general approach to begin communicating with the instruments and for debugging your programs. The steps within this procedure include:

Communication

- COMM1 : Verify communication with the instruments.

Debugging Programs

- DEBUG1 : Sending SCPI Commands
- DEBUG2 : Verify the System Logical Addresses
- DEBUG3 : Start Each Program by Fully Resetting Each Instrument
- DEBUG4 : Query the Instrument for Errors
- DEBUG5 : Query all Command Parameter Settings
- DEBUG6 : Verify that the Amount of Data to be Entered is Equal to the Amount of Data Generated
- DEBUG7 : Check the Instrument's Arm-Trigger Subsystem
- DEBUG8 : Execute Coupled Commands Within a Coupling Group
- DEBUG9 : Check for Command Synchronization Errors

COMM1 : Verify Communication with the Instruments

This step explains how VXI instruments are addressed, based on the computer controlling the system. The step also includes example programs that can be executed to verify communication.

COMM1A : GPIB Addressing

Instruments in the VXI mainframe that are programmed over GPIB are located by an GPIB address. The GPIB address is a combination of the controller's interface select code, the Command Module's primary GPIB address, and the instrument's secondary GPIB address. An address in this form in an BASIC statement appears as:

```
OUTPUT 70903;"command..."
```

Interface Select Code (7): Determined by the address of the GPIB interface card in the computer (controller). In most Agilent Technologies computers, this card (including the Agilent 82335 GPIB interface card used in PCs) has a factory-set address of 7.

Primary GPIB Address (09): This is the address of the GPIB port on the Command Module. Valid addresses are 0 to 30. The Command Module has a factory-set GPIB port address of 9.

Secondary GPIB Address (03): This address is derived from the logical address of the Instrument Identifier module by dividing the address by 8. Thus, for a logical address of 8, the secondary address is 01. For logical addresses of 16 and 24, the secondary addresses are 02 and 03, and so on.

The secondary GPIB address of the Agilent E1406/05 Command Module is **always** 00 regardless of its logical address.

Sending the *IDN? Command

The following programs send the *IDN? command to the Command Module to verify communication between the computer and the VXI mainframe. As an example, execution of the *IDN? command may return:

```
HEWLETT-PACKARD,E1406,0,A.09.00
```

BASIC Program

```
10  !Send the *IDN? command, enter and display the result.
20  DIM Message$[80]
30  OUTPUT 70900;"*IDN?"
40  ENTER 70900;Message$
50  PRINT Message$
60  END
```

C Language Program

```
/* This program sends the *IDN? command to the Command Module as a  */
/* way to determine if the computer is communicating with the mainframe */

     /* Include the following header files */

#include    <stdio.h>
#include    <cfunc.h>/* This file is from the GPIB Command Library Disk */

#define    ADDR 70900/* I/O path from the PC to the Command Module */
/*****************************************************/
void main(void)/* Run the program */
{
     char   message[80];
     int   length = 80;

     IOOUTPUTS(ADDR, "*IDN?", 5);/* send *IDN? command */
     IOENTERS(ADDR, message, &length);/* enter *IDN? response */

     printf("%s\n", message);/* print*IDN? response */
}
```

COMM1B : Embedded Controller Addressing

In systems containing message-based modules which are servants to the Agilent E1499A embedded V/382 controller, the modules are programmed from the VXIbus backplane rather than from the GPIB. The V/382 factory-set interface select code is 16.

Since no secondary address is required as when programming from the VXIbus backplane, the logical address of the message-based module is combined with the VXI interface select code.

For example, to program a message-based module with a logical address of 24, the OUTPUT statement in an BASIC program appears as:

OUTPUT 1624;"...

for logical addresses from 1 to 99

or

OUTPUT 160xxx;"...

for logical addresses from 100 to 255

See "Sending the *IDN? Command" in the section "GPIB Addressing" to verify communication over GPIB, between the V/382 and the Agilent

E1406/05 Command Module. See the sections "SICL Addressing" and "Compiled SCPI Addressing" for programs to verify communication with V/382 HP-UX operating systems.

COMM1C : SICL Addressing

In systems using the Standard Instrument Command Language (SICL), a communication channel must be opened between the computer and a VXI instrument. This communication channel is referred to as a device session. A device session is opened by specifying a device address within the IOPEN function. For example:

```
instrument = iopen("vxi,24");
```

opens a device session over the VXIbus between the computer and the VXI instrument at logical address 24. Similarly:

```
instrument = iopen("hpib,9,3");
```

opens a device session over GPIB between the computer and the VXI instrument at secondary GPIB address 3 (logical address 24).

Sending the *IDN? Command

The following SICL program sends the *IDN? command to the Agilent E1411B multimeter to verify communication between the computer and the VXI mainframe. As an example, execution of the *IDN? command may return:

```
HEWLETT-PACKARD,E1411B,0,B.05.00
```

```
#include   <stdio.h>
#include   <sicl.h>
#define SICL_NULL (INST) 0

INST instrument;
int main(void)
{
     char result[100];
     instrument = iopen("hpib,9,3");
     if (instrument == SICL_NULL)
     {
     printf("Error opening logical address\n");
     exit(1);
     }
     ipromptf(instrument, "*RST;*IDN?\n", "%t", result);

     /* eliminate line feed from string */
     result[strlen(result) - 1] = '\0';

     printf("*IDN? returned: %s\n", result);
     iclose(instrument);
     exit(0);
}
```

COMM1D : C-SCPI Addressing

In systems using Compiled SCPI (C-SCPI), the VXI instrument logical address is used to open a communication channel between the computer and the instrument. For example,

```
INST_OPEN(vm,"vxi,24");
```

opens a communication channel between the computer and the instrument (voltmeter) at logical address 24.

Sending the *IDN? Command

The following C-SCPI program sends the *IDN? command to the Agilent E1411B multimeter to verify communication between the computer and the VXI mainframe. As an example, execution of the *IDN? command may return:

```
HEWLETT-PACKARD,E1411B,0,B.05.00
```

```
#include   <stdio.h>
#include   <stdlib.h>
#include   <cscpi.h>

void main()
{
     char vm_id[80];
     INST_DECL(vm,"E1411B",REGISTER);
     INST_STARTUP();
     INST_OPEN(vm,"vxi,24");
     IF (vm == 0)
     {
     printf("open failed on vm\n");
     printf("cscpi open error number: %d\n", cscpi_open_error);
     exit(1);
     }
     INST_SEND(vm,"*RST\n");
     INST_QUERY(vm,"*IDN?\n", "%s",vm_id);
     printf("The id of this module is %s \n", vm_id);
     exit(0);
}
```

Debugging Programs

This section contains information to help you avoid programming mistakes and to debug your programs. The steps outlined below do not depend on any particular programming language.

Follow these steps as you write your program, or when the program is not producing the expected results. Steps DEBUG1 through DEBUG5 will help you find 80% of the errors that occur. Steps DEBUG6 through DEBUG9 will help you find the remaining 20% of the errors (which tend to be harder to track down).

DEBUG1 : Sending SCPI Commands

Standard Commands for Programmable Instruments (SCPI) is an ASCII-based instrument command language designed for test and measurement instruments. The Agilent E1406/05 Command Module interprets the ASCII command strings for its register-based servant modules. Agilent Technologies message-based modules have an on-board microprocessor which makes them capable of interpreting the command strings themselves.

SCPI Command Structure

SCPI commands are based on a hierarchical structure, also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus, forming subtrees or subsystems. An example is the Agilent E1445A Arbitrary Function Generator's "ARM" subsystem.

```
ARM
    [:STARt|SEQuence[1]]
        [:LAYer[1]]
            :COUNt <number>
        :LAYer2
            :COUNt <number>
            [:IMMediate]                [no query]
            :SLOPe <edge>
            :SOURce <source>

    :SWEep|SEQuence3
        :COUNt <number>
        [:IMMediate]                    [no query]
        :LINK <link>
        :SOURce <source>
```

ARM is the root keyword of the command, :STARt|SEQuence1 and :SWEep|SEQuence3 are second level keywords, :LAYer1 and :LAYer2 are third level keywords, and so on. A colon (:) always separates a command keyword from a lower level keyword as shown below.

```
ARM:LAY2:SOUR EXT
```

A semicolon (;) is used to separate two commands within the same subsystem, and can also save typing. For example, sending this command message:

```
ARM:LAY2:SOUR EXT;SLOP POS;COUN 10
```

is the same as sending these three commands:

```
ARM:LAY2:SOUR EXT
ARM:LAY2:SLOP POS
ARM:LAY2:COUN 10
```

Note that the semicolon (;) **and** colon (:) link commands within different subsystems. Only a semicolon (;) is required to link commands within the same subsystem.

Terminating Commands

All command sequences must end with a proper terminator called a program message terminator. This may be a Line Feed (LF), Line Feed with EOI (End-Or-Identify), or EOI. Most programming systems provide some method of specifying the terminator. BASIC for example, automatically provides a Line Feed at the end of all OUTPUT statements.

Data returned from a VXI instrument will always terminate with a Line Feed and EOI. BASIC ENTER statements will terminate with this.

DEBUG2 : Verify the System Logical Addresses

One of the most common errors encountered is a logical address that is set incorrectly. A common mistake is to interpret the most-significant-bit (MSB) for the least-significant-bit (LSB), or to interpret a 1 setting for a 0 setting.

Use the VXI:CONF:LADD? command to return a list of all logical addresses in the system. This allows you to verify that the system sees the switch settings as you intended.

```
/* reserve computer memory (approximately 128 bytes) for the data */
/* returned */
VXI:CONF:LADD?
/* enter and print results of command */
```

These logical addresses, divided by eight, are the secondary (GPIB) addresses of the instruments in the system.

You can execute the following query to find additional information about an instrument at a specific logical address:

```
/* select the instrument at logical address 24 */
VXI:SEL 24
/* send INFormation? command to receive information on the instrument */
/* enter and print the data returned */
VXI:CONF:INF?
```

DEBUG3 : Start Each Program by Fully Resetting Each Instrument

An instrument is fully reset when you cycle power or go through the three levels of the reset hierarchy. It is important to go through all levels in the proper order because some instruments can set conditions that can only be aborted by this sequence.

1. Issue an IEEE-488 Interface clear which will remove any bus deadlocks. (i.e. ABORT 7)

2. Issue an IEEE-488 selected device clear which will terminate instrument activity and clear the input/output buffers (i.e. CLEAR 70900).

3. Reset each instrument and wait for the reset to complete.

   *RST;*CLS;*ESE 0;*SRE 0;*OPC?

   /* enter the data (1) returned by *OPC? */

   *RST resets the instrument.

   *CLS;*ESE 0;*SRE 0 resets the instrument's status subsystem that is defined by IEEE 488.2.

   *OPC? outputs a "1" when all commands before it have completed.

DEBUG4 : Query the Instrument for Errors

SCPI defines that all instruments will have an error queue. Any time an error occurs, a message is placed in this queue. This error queue is read by sending the SYST:ERR? command.

Knowing that the error queue exists and reading it frequently is one of the most important things to do. Another common problem is to send a command string that has a syntax error. When the command is parsed and the error is detected, a message is written to the error queue. However, no other action is taken as the instrument does not know what the command was supposed to do. Generally, no indication of an error is given, and reading the error queue is the only way to get feedback if an error is detected.

```
/* repeat */
    SYST:ERR?
/* enter and print error data */
/* until there are no more errors in the queue */
```

DEBUG5 : Query all Command Parameter Settings

When the error queue contains an error, the next task is to determine which command caused it. When a command has an error, it is not executed. An effective debugging technique is to query previously sent commands for their current settings. When a queried setting doesn't match what was to be set, then the error exists in the corresponding command.

The most common command-related errors are:

- misspelled commands
- eliminating the space between the command and the first parameter
- parameters out of range
- settings conflict errors caused by coupled commands not executed within a coupling group

DEBUG6 : Verify that the Amount of Data to be Entered is Equal to the Amount of Data Generated

Another error which frequently occurs is not receiving the exact amount of data expected from the instrument. Check the parameter settings as in step DEBUG5, and then compare this with the number of data items programmed to receive. Also notice whether arrays start with zero or one. Multiple results to one query command will be separated by commas.

DEBUG7 : Check the Instrument's Arm-Trigger Subsystem

All SCPI instruments follow an Arm-Trigger model that is described in most operating manuals and in the "Beginner's Guide to SCPI" document. This model has both required and optional levels:

IDLE	required
ARM:LAYer<x>	optional
ARM:LAYer<2>	optional
ARM:LAYer1	optional
INITIATED	required
TRIGger	optional
sequence operation	required

The Arm-Trigger subsystem starts with the IDLE state which occurs at power-on, following ABORT or *RST, or after a previous Arm-Trigger cycle that has completed.

Command configuration occurs when the instrument is in the IDLE state. After the instrument has been configured (including its ARM and TRIGger functions), the INITiate command is executed which moves the instrument to the INITIATED state. Once initiated, reception of the appropriate arm and trigger signals start the sequence operation.

Since each instrument may implement different ARM layers, TRIGger sources, etc., refer to the operating manual for information on the exact ARM/TRIGger sequence used.

An example ARM/TRIGger sequence follows:

```
/* Program a Function Generator to output 100 cycles of a waveform
whenever a signal is applied to its "Aux In" port */

/* Arm source = Aux In port source */
ARM:STAR:LAY2:SOUR EXT;

/* Infinite number of Aux In arms */
ARM:STAR:LAY2:COUN INF;

/* 100 cycles */
ARM:STAR:LAY1:COUN 1E2

/* Initiate the waveform (trigger source internal) */
INIT
```

DEBUG8 : Execute Coupled Commands Within a Coupling Group

Certain SCPI commands are functional coupled or value coupled. Functionally coupled commands are those that for one command to have affect, another command must be set to a particular value. Value coupled commands are those where changing the value of one command, changes the value of the others.

Coupled commands can cause “Settings conflict” errors when the program executes. When a coupled command is executed, the command setting is evaluated by the Command Module’s (or message-based instrument’s) processor. If the setting causes an illegal digitizer configuration, a "Settings conflict" error occurs. The error message lists the conflicting settings, and then reports the values set by the processor.

The "Comments" section of each command reference entry in the instrument manual usually indicates if a command is coupled, and if it is, what the coupling constraints are.

How to Execute Coupled Commands

To prevent possible "Settings conflict" errors, coupled commands must be contiguous and executed in the same program statement. This is done by placing the commands in the same program line, or for BASIC programs, by suppressing the EOL terminator until the last (coupled) command has been sent.

To send multiple commands in a single line or in a single statement, the commands are linked with a semicolon (;) and a colon (:). This is illustrated in the following lines:

```
OUTP:EXT1:STAT ON;:TRIG:SOUR EXT1;:OUTP:EXT1:STAT OFF
```

or

```
OUTP:EXT1:STAT ON;
:TRIG:SOUR EXT1;
:OUTP:EXT1:STAT OFF
```

Notice that the semicolon (;) **and** colon (:) link commands within different subsystems. Only a semicolon (;) is required to link commands at the same level within the same subsystem.

In an instrument where the previous commands are coupled, sending the commands as shown prevents "Settings conflict" errors. The command settings are not evaluated until the EOL terminator is received after the last command. If these commands were sent individually (an EOL terminator after each command), a "Settings conflict" error would occur because of the coupling between OUTP:EXT1:STAT ON and TRIG:SOUR EXT1.

DEBUG9 : Check for Command Synchronization Errors

IEEE 488.2 specifies that all instruments will have an input buffer and that execution of these commands does not start until a program message terminator is received (i.e. Line Feed, Line Feed with EOI, or EOI).

A common problem is the computer will send commands to the input buffers of two instruments. It is possible that the second instrument may execute its commands before the first instrument executes the commands. Thus, instruments may execute their functions in an order that is different from the command sequence in the computer program.

Synchronization of instrument-to-computer is accomplished by sending a command that returns data. The computer must wait for the data to be returned. The *OPC? command defined by IEEE 488.2 was created for this purpose. *OPC? will return a one (1) when the commands before it have finished executing.

The following example closes four relays and waits for the command to complete before continuing with the next command:

```
CLOSE (@100,101,102,103);*OPC?
/* enter the data returned by *OPC? (1) */
READ?
```

Appendix A: Terms and Definitions

This chapter contains additional information on specific terms and functions refereed to in the procedures throughout this manual. The following topics are covered:

- Resource Manager.....A-2
- Slot 0 Functionality.....A-2
- 10 MHz Clock Source.....A-3
- Bus Request Level A-3
- Command Module Memory.....A-4
- Servant Area.....A-5
- Primary GPIB Address A-7
- VXI-MXI Interface A-8
- What is an Instrument Identifier? A-9
- Virtual Instruments A-9
- Logical Address A-10
- Downloadable Instrument Drivers.....A-11
- Display Terminals.....A-12
- Interrupt Lines.....A-12

What is the Resource Manager?

Every VXIbus system must have a module that provides the system's resource manager requirements. The resource manager function in modules with this capability, such as the Command Module, is activated by setting the **logical address** to 0.

At power-on, the resource manager function is started. The purpose of the resource manager is to:

- identify all plug-in modules installed in the C-size mainframe
- set commander/servant hierarchies whereby one or more plug-in modules *control* other plug-in modules
- perform A24/A32 address mapping so that modules requiring additional addressing can receive it
- allocate interrupt lines to manage communication between interrupt handler modules and interrupter modules
- start system operation

Once the power-on sequence is completed and the system is started, the resource manager is no longer used.

What are the Slot 0 Functions?

Every VXIbus system must have a module that provides the slot 0 functionality. Modules that have slot 0 functionality include the Agilent E1406/05 Command Module, Agilent E1482B VXI-MXI Module, Agilent E1499A Embedded V/382 Controller, Agilent E1497A/E1498A Embedded V743 Controllers, and the Agilent RADI-EPC7 Embedded Computer. The module set up as the slot 0 device must then be installed in the mainframe's slot 0.

The slot 0 functionality is used during operation for the following purposes:

- locate where modules are installed in the mainframe.
- manage (arbitrate) data flow across the VXIbus backplane busses
- provide the system clock (SYSCLK - 16 MHz)

What is the Command Module's 10 MHz Clock Source?

One of the slot 0 resources supplied by the Command Module is the 10 MHz system clock: CLK10. This clock is distributed to every slot along the VXIbus backplane. The clock may be an internal signal generated by the Command Module, or an external signal supplied to the backplane via the SMB faceplate connector on the Command Module. The following guidelines will help you set the system clock configuration:

- The Agilent E1406 Command Module's CLK10 source is set to "Internal" at the factory.
- The initial accuracy of the internal 10 MHz ECL clock is ± 50 ppm. The duty cycle is 50% ±5%.
- The CLK10 source can be routed to external devices using the 'Clk Out' SMB connector.
- If an external clock is selected, the signal is input to the Command Module through the 'Clk In' SMB connector.
- Disabling the slot 0 and (VME) System Controller functions removes the internal system clock or external clock from the VXIbus backplane. However, the clock from either source is still present at the 'Clk Out' SMB connector.

What is the Command Module's Bus Request Level?

The bus request level is a priority at which the Agilent E1406 Command Module can request the use of the Data Transfer Bus. The following guidelines will help you set the level:

- There are four bus request levels to choose from: 0 - 3. Bus request level 3 has the highest priority; bus request level 0 has the lowest priority.
- The Command Module's bus request level switch is set to 3 at the factory. In most VXIbus systems and configurations, it is not necessary to change this setting.

Data Transfer Bus Arbitration

In a VXIbus system, the Data Transfer Bus (DTB) is used for addressing and data transfer. As a result, many instruments in a typical VXIbus system request the use of the bus. Arbitration of the DTB is done by the slot 0 module, using a Fair Requester protocol. This protocol requires that once a module has requested and has been granted the bus, it may not request the bus again until 30 ns after the bus request line is released. Although the bus grant signal is daisy-chained from module to module, the 30 ns delay prevents a module in a lower slot from continually being granted the bus. The Command Module, even though it may be the slot 0 module, must also request the bus in the same manner as any other module.

This form of arbitration occurs on any bus request level (0 - 3) selected. However, because of the bus request level priority, a module requesting the DTB from bus request level 3 would be granted the DTB before a module requesting the bus from request level 0, 1, or 2.

NOTE *In multiple mainframe systems, (data transfer) bus arbitration must be provided by the Agilent E1482B VXIbus Extender Module and not by the Command Module.*

What is Command Module Memory

The standard Agilent E1406A comes equipped with 1.25 Mbytes of flash ROM, 512 Kbytes of non-volatile RAM, and 256 Kbytes of shared RAM. The module's memory configuration and usage is shown in Figure A-1.

Command Module Memory	Contents
Flash ROM	
1.25 Mbytes *	- operating system
1.75 Mbytes	- device drivers
Non-Volatile RAM	
512 Kbytes *	- device drivers
1 Mbytes	- IBASIC programs and data, RAM disk
2 Mbytes	- system parameters
Shared RAM	
256 Kbytes*	- available to VXIbus system
none	

* = standard configuration

Figure A-1. Agilent E1406A Memory Configuration

What is the Servant Area?

In a VXIbus system, modules in the servant area of another module are servants to that module (the commander). The commander module controls servant modules by translating Standard Commands for Programmable Instruments (SCPI) commands for register-based modules, or by serving as the GPIB interface to message-based modules. The concept of the servant area and commander/servant hierarchies is shown in Figure A-2.

In addition to setting the Agilent E1406/05 Command Module as the resource manager, the logical address is used with the servant area switch setting to determine the servant area of the Command Module:

Servant area = (logical address + 1) through (logical address + servant area switch setting)

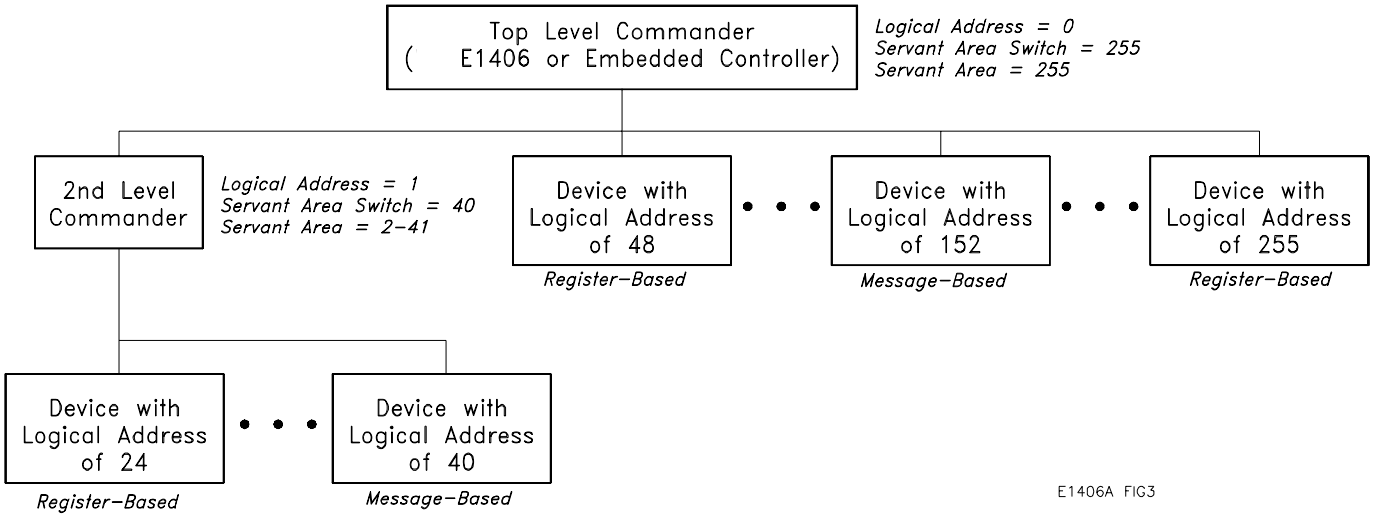


Figure A-2. Commander/Servant Hierarchy

Servant Area with the Command Module as Resource Manager/Slot 0 Device

The Command Module should be set so it is the top level commander. The Command Module's logical address setting is combined with its servant area switch setting to define the Command Module's servant area.

When the Command Module is the resource manager, its logical address is 0. To set the Command Module as the top level commander, its servant area switch should be set to 255. Then the Command Module's servant area includes all modules with logical addresses from 1 through 255.

The Command Module controls servant modules by translating Standard Commands for Programmable Instruments (SCPI) commands for register-based modules, or by serving as the GPIB interface to message-based modules.

When the Command Module is the resource manager/slot 0 device, the following guidelines apply:

- The Command Module should be the commander for the system's Agilent Technologies register-based modules. This enables Agilent's register-based modules to be programmed with SCPI commands via the Command Module. The Command Module should also be the commander for the system's message-based modules so that the Command Module will serve as the GPIB interface to those modules.
- The Command Module will always be the commander of Instrument BASIC (IBASIC) whether or not IBASIC is in the Command Module's servant area.
- A commander may be a servant to another commander (forming a hierarchical system as shown in Figure A-2). Servants in the servant area of the "lower-level" commander are controlled by the lower-level commander.

Servant Area with an Embedded Computer as Resource Manager/Slot 0 Device

An embedded computer, such as the Agilent E1499A V/382, should be the commander for the system's message-based modules (including other commanders). Modules such as the Agilent E1406/05 Command Module should be the commander for the system's register-based modules. This enables Agilent Technologies' register-based modules to be programmed with SCPI commands via the Command Module.

A commander may be a servant to another commander (forming a hierarchical system). Servants in the servant area of the "lower-level" commander are controlled by the lower-level commander.

The embedded computer's servant area should be set to 255. Thus, if the embedded computer's logical address is 0 and its servant area setting is 255, the embedded computer will be the top-level commander for all modules with logical address between 1 and 255.

When the command module is a servant to an embedded computer, the following guidelines apply:

- For the Command Module to be the commander for a register-based module, the register-based module's logical address must fall within the Command Module's servant area.
- The Command Module's logical address plus the Command Module's servant area cannot exceed 255. Recommended Command Module logical addresses are 1, 2, and 3 (0 is reserved for the resource manager, the embedded computer). Therefore, the servant area should be set based on the logical addresses of the register-based modules in your system.

What is the Command Module's Primary GPIB Address?

GPIB is the implementation of ANSI/IEEE Standard 488.1-1978 "IEEE Standard Digital Interface for Programmable Instrumentation". The primary GPIB address identifies the GPIB port on the Command Module. This address is combined with the Command Module's secondary GPIB address (always 00), and with the external computer's (GPIB) interface select code (typically 7 for HP Computers), to form the Command Module's complete GPIB address.

The following guidelines will help you set the Command Module's primary GPIB address:

- The Command Module has a factory-set GPIB address of 9. If there is only one Command Module (i.e. only one GPIB port) in your VXIbus mainframe, then it is not necessary to change this setting. If there are additional Command Modules in a system connected to the same computer GPIB interface card, each module must have a unique primary GPIB address.
- Valid primary GPIB addresses are 0 through 30.

What is the VXI-MXI Module?

With the Agilent E1482B VXI-MXI mainframe extender module, multiple E1401A/E1400B mainframes are integrated into a single VXIbus system. The Agilent E1482 extends the VXI backplane from mainframe to mainframe by converting VXIbus signals to and from the appropriate MXIbus signals, and transmitting them over the MXIbus cables.

For detailed information on VXI-MXI extender module configuration, refer to the *Agilent E1482B VXI-MXI Bus Extender User's Manual*.

When E1482 VXI-MXI mainframe extender modules are part of your system, the MXI modules must function as the Data Transfer Bus (DTB) timer. This means the bus timer capability of the Command Module or V/382 Controller must be disabled. This is done by setting the 'VME BTO Disable' switch (Command Module) or 'VXIbus Error Timer' switch (V/382). The bus timer capability of the V743 controller does not have to be disabled. If you are using an EPC7 as system controller, the EPC7 must be a non-slot 0 device and installed in a slot other than slot 0. This is described in Procedure 3: Set Up the System for Multiple Mainframes.

What are the VXI-MXI Logical Address Windows

Each mainframe in a multiple-mainframe VXIbus system is allocated a logical address window. The window is allocated by the resource manager during the power-on sequence. The size and starting address of the logical address window is determined by the logical addresses of the modules in each mainframe. When setting the logical addresses of the modules, note the following guidelines.

- The logical address of the VXI-MXI extender module in mainframe 1 should be set to 1, 2, 3, ... The logical addresses of the VXI-MXI modules in the other mainframes should be set to values near the starting address of that mainframe's logical address window. For example, if a mainframe's logical address window is 128 to 159, set the VXI-MXI extender module's address to 129, 130, ... This allows for a register-based module to be set to 128, and then be assigned a secondary GPIB address (16) by the Command Module resource manager.

- The logical address window size is set to a power of 2 (2, 4, 8,...). The size is the number of logical addresses in the window. The starting address is an integer multiple of the size. For example, to allocate a window for 30 logical addresses, the resource manager will set a window size of 32. Valid starting addresses are 0, 32, 64, 96, 128, 160, 192, or 224.

  Incidentally, the logical address of the VXI-MXI extender module in that mainframe should be set to 1, 33, 65, 97, ...

- The logical address window of the root mainframe must be a valid window (valid starting address and size), and include all of the modules in all of the extender mainframes connected to it.

- No module in one mainframe can be in another mainframe's logical address window. Therefore, the logical addresses within a mainframe should be set such that as small a window as possible is allocated.

- The logical address window of an extender mainframe must include all modules in that mainframe. The VXI-MXI extender module, however, does not have to be within the window, but must not be within the window of another mainframe.

See the *Agilent E1482B VXI-MXI Bus Extender User's Manual* for additional information on determining the Logical Address Window.

What is an Instrument Identifier?

Instruments comprised of Agilent Technologies message-based and register-based modules which are servants to the Agilent E1406/05 Command Module are created according to the following rules:

- Each instrument must have one plug-in module assigned as an **Instrument Identifier**. The Instrument Identifier is the module with its logical address set to a multiple of 8, such as 8, 16, or 24.

- The Instrument Identifier is the lowest logical address in the instrument. *The Command Module maps the Instrument Identifier logical address to a secondary GPIB address by dividing the logical address by 8*. Thus, a logical address of 8 maps to a secondary GPIB address of 1; logical address 16 maps to secondary address 2; logical address 24 maps to 3 and so on.

- If an instrument consists of a single module, then its logical address must be set to an Instrument Identifier address (multiple of 8).

What are Virtual Instruments?

- An instrument consisting of multiple modules is called a **virtual instrument**. The modules of the virtual instrument must be assigned successive logical addresses beginning with the address of the Instrument Identifier. For example, to create a scanning multimeter virtual instrument which consists of a multimeter and two multiplexers, the logical addresses could be set to:

    24 (multimeter)
    25 (1st multiplexer)
    26 (2nd multiplexer)

Note, however, you *cannot* combine multiple modules of the same type such as multimeters, counters, and function generators into virtual instruments.

What is the Logical Address?

Every device in a VXIbus system has a unique logical address. In Agilent VXIbus systems, the logical address is used to:

- Create instruments
- Establish servant areas
- Derive secondary GPIB addresses that are used to program instruments from the GPIB
- Determine the base address of the device's registers in A16 address space
- Set the device as the system resource manager (Agilent E1406 Command Module)

Setting the Logical Address

The following guidelines will help you set logical addresses:

- Notice the factory-set logical address. Most Agilent Technologies modules such as DMMs, counters, and function generators have a factory-set address that is an Instrument Identifier (multiple of 8, 8, 16, 32, etc).
- Valid logical addresses are 1 through 255. To dynamically configure a module which supports dynamic configuration, its logical address must be set to 255. However, if a statically configured module is set to 255, the resource manager will not dynamically configure any module.
- If your system consists of statically and dynamically configured modules, set the statically configured modules to the "lower" multiples of 8 (e.g. 8, 16, 24). The dynamically configured modules will be assigned Instrument Identifier addresses beginning with the lowest available multiple of 8. If all multiples are used, the dynamically configured module is given the first available address.
- A plug-in module with a logical address that is not a multiple of 8, or that is not part of a virtual instrument, is an unassigned module. Such modules must be programmed at the register level, rather than with SCPI commands. (A secondary GPIB address can be given to an unassigned module with the Command Module's User-Defined Commander/Servant Hierarchy table (see the Agilent E1406 User's Manual).)

What are Downloadable Instrument Drivers?

Instrument drivers enable Agilent Technologies register-based modules to be programmed using SCPI commands. The following table lists the Agilent E1406A Command Module's factory-installed instrument drivers.

Agilent E1406/05 Factory-Installed Instrument Drivers (Register-Based Modules)	
System Instrument	
Agilent E1326B/E1411B	5 1/2-Digit Multimeters
Agilent E1328A	4-Channel D/A Converter
Agilent E1330B	Quad 8-Bit Digital Input/Output
Agilent E1332A	4-Channel Counter/Totalizer
Agilent E1333A	3-Channel Universal Counter
Switch Cards	Multiplexers, Matrix, General Purpose

Drivers that are not factory-installed ship with the register-based module. The easiest way to download drivers to the Command Module is to use Agilent VIC or the driver download utility that is included with Agilent VIC.

If you do not have Agilent VIC or the download utility, instructions for downloading the drivers are contained in the "Downloading Device Drivers Installation Note" (p/n E1401-90021).

If a driver is not installed, the resource manager will report the following message at the end of the power-on sequence.

WARNING: DEVICE DRIVER NOT FOUND

Note *Agilent VIC (Agilent VXI Installation Consultant) ships with the Agilent E1406A Command Module on a 3.5" flexible disk.*

What Display Terminals Can Be Used?

The Command Module has a 9-pin DTE RS-232 connector. You can connect a terminal or PC to the Command Module using the RS-232 interface. Such connections can display the Command Module's power-on and configuration sequence, and function as a front panel to your VXIbus C-Size system.

The Command Module's RS-232 interface is factory-configured as shown in the following table.

Baud Rate	9600	RecvPace	Xon/Xoff
Parity	None	XmitPace	Xon/Xoff
Data Bits	8 Character Size	EnqAck	No (Agilent terminals)

The terminals supported by the Command Module RS-232 interface include:

- HP 700/92
- HP 700/94
- HP 700/22
- HP 700/41 and WYSE WY-30®

Other terminals that may work include:

- HP 2392A
- HP 2394A
- DEC® VT100®
- DEC® VT220®
- WYSE® WY-50®
- HP AdvanceLink terminal emulation software (configure as HP 2392A)

What are Interrupt Lines?

In a VXIbus system, communication and coordination between a commander and its servants is often achieved using the VXIbus backplane interrupt lines. Such is the case with the Agilent E1406/05 Command Module and Agilent Technologies's register-based modules.

There are seven backplane interrupt lines. These lines are assigned to devices by the resource manager during the system's power-on sequence. When a controller such as the Agilent V/382 or Agilent V743 is the resource manager, it assigns line 1 to itself, and assigns lines 2 through 7 to other interrupt handlers in the system. In systems containing an Agilent V/382 or Agilent V743 (as resource manager) and an Agilent E1406/05 Command Module, the Agilent V/382 or Agilent V743 will assign the Command Module interrupt line 2 - if the Command Module has the next lowest logical address.

Appendix B : Configuration and Start-up Errors

The Agilent E1406 Command Module error messages associated with system installation and configuration are shown on the following pages. These messages are displayed if a terminal or printer is connected to the Command Module's RS-232 port. If a terminal or printer is not used, the messages can be read from the system instrument error queue, using SYST:ERR?. An BASIC example using SYST:ERR? is shown below:

```
DIM Err_msg$[256]
REPEAT
   OUTPUT 70900;"SYST:ERR?"
   ENTER 70900;Code,Err_msg$
   PRINT Code,Err_msg$
UNTIL Code=0
```

NOTE *Error codes read from the error queue are preceded by the number 21. For example, error code 11 displayed on a monitor would appear as 2111 if read from the error queue instead.*

NOTE *If a fatal error has occurred and the system instrument is not started, SYST:ERR? cannot be used to read the error queue.*

Table 1. Command Module Resource Manager Configuration Errors

Error	Message	Cause
1	FAILED DEVICE	A device failed its power-on self-test. A device failed if the resource manager finds the PASSED bit false. The test is done five seconds after power-on, or when the operating system has determined that *SYSFAIL is not asserted.
2	UNABLE TO COMBINE DEVICE	A device cannot be combined as part of a virtual instrument.
WARNING	DEVICE DRIVER NOT FOUND	A device's VXI driver is not in the Command Module. The resource manager expects to find a driver for all register-based or message-based devices that are not I or I4. The device can be accessed through its registers.
4	DC DEVICE ADDRESS BLOCK TOO BIG	The block of addresses required to dynamically configure devices is greater than 127. The VXI specification allows blocks larger than 127. However, due to the VXI specification restrictions on where DC blocks can be located, the resource manager rejects blocks larger than 127 since these blocks would have to start at either 0 which is used by the resource manager, or use address 255 which disables dynamic configuration.
5	A24 MEMORY OVERFLOW	There is not enough available A24 memory required for a device. The allowable memory space is from 200000h to FFFFFFh (E00000h - FFFFFFh is only used if there is an 8 Mbyte device in the system). If your system has (mainframe) extenders, try using the user-defined extender table to allocate the memory more efficiently.
6	A32 MEMORY OVERFLOW	There is not enough available A32 memory required for a device. The allowable memory space is from 20000000h to FFFFFFFFh (E0000000h - FFFFFFFFh is only used if there is a 2000 Mbyte device in the system). If your system has (mainframe) extenders, try using the user-defined extender table to allocate the memory more efficiently.
7	DC DEVICE MOVE FAILED	A dynamically configured device did not move to its new logical address.After setting a DC device (or a block of devices), the resource manager checks the new address(es) to see if the device(s) actually moved.
8	INACCESSIBLE A24 MEMORY	An A24 device has memory below 200000h or above DFFFFFh. The Command Module cannot access this memory.
9	UNABLE TO MOVE DC DEVICE	There is no logical address (or address block) available for a dynamically configured device to move to.Try using a user-defined dynamic configuration table or the user-defined extender table to assign the addresses more efficiently.
10	INSUFFICIENT SYSTEM MEMORY	Too many instruments are installed for the amount of RAM available in the Command Module. Only the system instrument is started.
11	INVALID INSTRUMENT ADDRESS	A module's logical address is not a multiple of 8, or is not part of a virtual instrument. Secondary GPIB addresses are only given to devices with logical addresses that are multiples of eight.
12	INVALID UDEF COMMANDER LADD	The user-defined commander logical address is not a valid commander. Either the commander does not exist, or it is not a message-based device.

Table 1. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
13	LADD OR IACK SWITCH SET WRONG	Either a device logical address is set incorrectly, or the interrupt switches on the mainframe backplane are set incorrectly.
14	INVALID UDEF SECONDARY ADDRESS	Invalid user-defined secondary address specified in the commander/servant hierarchy table.The secondary address specified was not 0 - 30, the address was 0 which is the Command Module address, or the module is not in the servant area of the Command Module.
15	DUPLICATE SECONDARY ADDRESS	The same secondary address was specified for more than one module in the user-defined commander/servant hierarchy table.
16	INVALID SERVANT AREA	The servant area of a commander is greater than 255, or the servant area of a servant module is greater than that of its commander. An invalid servant area is truncated to an allowable range and system configuration continues.
17	SLOT 0 FUNCTIONS DISABLED	The Command Module is installed in slot 0 and its Slot 0 and System Controller switches are set to 'Disable'.
18	INVALID COMMANDER LADD	The commander specified in the user-defined commander/servant hierarchy table is not a valid message-based commander, or the device does not exist.
19	BNO FAILED	BNO was issued to a message-based device whose response indicated an error condition. The Begin Normal Operation command may have failed or the device returned a response other than FFFEh. (See the VXI specification for a description of the BNO response.)
20	WRITE READY TIMEOUT	The Command Module timed out waiting for write ready to be asserted by a message-based device. The Command Module/resource manager was attempting to send a word serial command to a message-based device but write ready was not asserted on the device within 60 seconds. This can occur either before or after the command was sent. If before, the Command Module timed out without sending the command. If after, the Command Module timed out while determining if ERR* was asserted by the message-based device.
21	READ READY TIMEOUT	The Command Module timed out waiting for read ready to be asserted by a message-based device. The Command Module was attempting to read the response to a message-based query command, but read ready was not asserted on the device within 60 seconds.
22	ERR* ASSERTED	A word serial protocol error occurred. The Command Module/resource manager detected a word serial protocol violation due to a word serial command. The Command Module checks for ERR* asserted before and after sending a word serial command to a message-based device. If ERR* is asserted before, the command is not sent. This error also occurs if the Command Module is not the resource manager and it receives a word serial command it does not recognize.
23	ENO FAILED	ENO was issued to a message-based device whose response indicated an error condition. Proper ending of normal operation is the response FFFEh.

Table 1. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
24	INTERRUPT LINE UNAVAILABLE	The interrupt line assigned by the user-defined interrupt line table is not available. Either the line has been assigned or has been reserved. This error also occurs if the line being assigned to an interrupter is not handled by the interrupter's commander.
25	INVALID UDEF HANDLER	A user-defined interrupt handler specified in the interrupt line allocation table is invalid. The handler logical address may not be valid, the device may not be a programmable handler, or the device has been assigned as many lines as it can handle.
26	INVALID UDEF INTERRUPTER	A user-defined interrupter specified in the interrupt line allocation table is not a valid interrupter. The interrupter logical address may not be valid, the device may not be a programmable interrupter, or the device has been assigned as many lines as it can interrupt on.
WARNING	DIAGNOSTIC MODE ON	The diagnostic switch on the Command Module is set to '1'. Only the system instrument is started. No other modules receive BNO.
WARNING	RESOURCE MANAGER NOT IN SLOT 0	The Command Module is the resource manager (logical address = 0) but is not installed in slot 0. The Command Module will configure the system but will not do dynamic configuration.
WARNING	SYSFAIL DETECTED	SYSFAIL occurred during operation. The resource manager re-boots.
30	PSEUDO INSTRUMENT LADD UNAVAILABLE	The logical address requested by a pseudo instrument (e.g. IBASIC) is already in use. Pseudo devices request a particular logical address. This error occurs if the logical address is used by a static or dynamically configured device.
31	FILE SYSTEM START UP FAILED	There is not enough memory in the Command Module to set up the file system required for IBASIC.
32	INACCESSIBLE A32 MEMORY	An A32 device has memory below 20000000 or above DFFFFFFF. The Command Module can assign, but cannot access A32 memory.
33	INVALID UDEF MEMORY BLOCK	The base address specified in the A24/A32 address allocation table is invalid, or the address block exceeds FFFFFFh in A24 memory.
34	UDEF MEMORY BLOCK UNAVAILABLE	The memory block specified in the A24/A32 address allocation table has already been assigned. Also, in a system with VXI-MXI VXIbus extenders, A24/A32 window restrictions may force some addresses to unavailable on a given VMEbus.
35	INVALID UDEF ADDRESS SPACE	An invalid A24/A32 address space specifier was used in the A24/A32 address allocation table.
36	DUPLICATE UDEF MEMORY LADD	A logical address is specified more than once in the same A24/A32 address allocation table.
37	INVALID UDEF CNFG TABLE	The valid flag in the user-defined commander/servant hierarchy table is not true (1). VXI:CONF:CTAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.

Table 1. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
38	INVALID UDEF CNFG TABLE DATA	There are 0, or greater than 254 entries in the user-defined commander/servant hierarchy table.
39	INVALID UDEF DC TABLE	The valid flag in the user-defined dynamic configuration table is not true (1). VXI:CONF:DCT <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
40	INVALID UDEF DC TABLE DATA	There are 0, or greater than 254 entries in the user-defined dynamic configuration table.
41	INVALID UDEF INTR TABLE	The valid flag in the user-defined interrupt line allocation table is not true (1). VXI:CONF:ITAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
42	INVALID UDEF INTR TABLE DATA	The interrupt line allocation table has invalid data. The number of records is less than 1 or greater than 7, the interrupt line specified is less than 1 or greater than 7, or the number of interrupters or handler ID is less than 1 or greater than 254.
43	INVALID UDEF MEM TABLE	The valid flag in the user-defined A24/A32 address allocation table is not true (1). VXI:CONF:MTAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
44	INVALID UDEF MEM TABLE DATA	An invalid logical address was specified in the A24/A32 address allocation table. The logical address range is 0 to 255 or -1.
WARNING	NVRAM CONTENTS LOST	System non-volatile memory was cleared during a re-boot. DIAG:BOOT:COLD was executed or the memory had a invalid checksum.
46	MESG BASED OPEN ACCESS FAILED	IBASIC or GPIB access to a message-based device failed because of a device failure. The resource manager tries to open a paths between the GPIB port and/or IBASIC and message-based devices (I and I4) using word serial commands. The device either failed to respond, or the device violates the VXI word serial protocol specification.
47	GRANTED DEVICE NOT FOUND	The Command Module, when not the resource manager, was granted a device that does not exist.
WARNING	DRAM CONTENTS LOST	Downloaded driver non-volatile memory was cleared during a re-boot. DIAG:BOOT:COLD was executed or the memory had a invalid checksum.
49	VME SYSTEM CONTROLLER DISABLED	The System Controller switch on the Command Module is set to the 'Disable' position.
50	EXTENDER NOT SLOT 0 DEVICE	A VXI-MXI mainframe extender module is not in slot 0 of its (remote) mainframe.
51	INVALID EXTENDER LADD WINDOW	Modules do not fit in the logical address window set by the user-defined extender table. Not all of the devices found "below" an extender will fit into the largest available window for that extender. Either reset the logical addresses or use the extender table to override the default algorithm.

Table 1. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
52	DEVICE OUTSIDE OF LADD WINDOW	A module in a (extender) mainframe is outside of the logical address window set by the resource manager or set by the user-defined extender table. Either reset the logical addresses or download a new extender table.
53	INVALID EXTENDER A24 WINDOW	The resource manager found an invalid start address or size for an extender A24 address window. Either reconfigure the VME memory devices or use the extender table.
54	DEVICE OUTSIDE OF A24 WINDOW	A module with A24 memory is located outside of the extender logical address window. Either reconfigure the VME memory devices or use the extender table.
55	INVALID EXTENDER A32 WINDOW	The resource manager found an invalid start address or size for an extender A32 address window. Either reconfigure the VME memory devices or use the extender table.
56	DEVICE OUTSIDE OF A32 WINDOW	A module with A32 memory is located outside of the extender logical address window. Either reconfigure the VME memory devices or use the extender table.
57	INVALID UDEF LADD WINDOW	A user-defined logical address window violates the VXI-6 specification (has an invalid base or size).
58	INVALID UDEF A16 WINDOW	A user-defined A16 window violates the VXI-6 specification (has an invalid base or size).
59	INVALID UDEF A24 WINDOW	A user-defined A24 window violates the VXI-6 specification (has an invalid base or size).
60	INVALID UDEF A32 WINDOW	A user-defined A32 window violates the VXI-6 specification (has an invalid base or size).
61	INVALID UDEF EXT TABLE	The valid flag in the user-defined extender table is not true (1). The valid flag must be set to '1' or the table is assumed to be invalid. To disable the table without re-booting, set the table address to '0' using VXI:CONF:ETAB 0.
62	INVALID UDEF EXT TABLE DATA	There are an invalid number of records in the user-defined extender table. The number of records must be a number between 1 and 254.
63	UNSUPPORTED UDEF TTL TRIGGER	There is a user-defined extender table TTL trigger entry for a VXI-MXI extender that does not support TTL triggers.
64	UNSUPPORTED UDEF ECL TRIGGER	There is a user-defined extender table ECL trigger entry for a VXI-MXI extender that does not support ECL triggers.
65	DEVICE NOT IN CONFIGURE STATE	A message-based device was not in the CONFIGURE state during a re-boot. The *SYSRESET should propagate to all mainframes through the INTX cables. Check the INTX connectors on remote mainframes.
66	INTX CARD NOT INSTALLED	INTX daughter card is not installed on the VXI-MXI extender module. The resource manager expects the INTX card to be installed in order for *SYSRESET and interrupts to propagate throughout the system.
WARNING	FLASH ROM DRIVER CONTENTS LOST	Downloaded instrument drivers stored in the flash ROM are not available for use by the resource manager. Erase and reprogram the driver portion of the flash ROM.

Checking for Instrument Errors

The following BASIC program is a method of checking for errors as you program the instruments (plug-in modules) in your VXIbus system. The program monitors the instrument's Standard Event Status Register for error conditions. If no errors occur, the instrument functions as programmed. If errors are detected, the instrument interrupts the controller. The controller reads the error codes and messages from the instrument's error queue and displays them. In this program, the instrument (multimeter) at secondary GPIB address 03 (logical address 24) is monitored. The controller commands used are for an HP Series 300 controller (external or an embedded controller) running the BASIC language.

NOTE *If an RS-232 display terminal is used, typing:*

SYST:ERR?

at the VOLTMTR_24: prompt reads and displays the error messages from the multimeter's error queue.

```
1 !Call controller subprogram "Errmsg" when a programming error occurs.
2 !Enable the controller to respond to an interrupt from the instrument.
10  ON INTR 7 CALL Errmsg
20  ENABLE INTR 7;2
21   !Unmask the Event Status bit in the instrument's Status Byte register.
22   !Unmask  error conditions in instrument's Standard Event Status
Register.
30  OUTPUT 70903;"*SRE 32"
40  OUTPUT 70903;"*ESE 60"
41  !Program the instrument for the application
50  OUTPUT 70903;"...
60  OUTPUT 70903;"...
70  OUTPUT 70903;"...
71   !Allow the controller to respond if an error occurs.
80  WAIT 2
90  END
91   !When an error occurs, clear the instrument to regain control. Execute a
92   !serial poll to clear the service request bit in the Status Byte register.
93   !Read all error messages in the instrument's error queue. Clear all bits in
94  !the instrument's Standard Event Status register.
100  SUB Errmsg
110   DIM Message$[256]
120    CLEAR 70903
130    B=SPOLL 70903
140    REPEAT
150       OUTPUT 70903;"SYST:ERR?"
160       ENTER 70903;Code,Message$
170       PRINT Code,Message$
180    UNTIL Code=0
190    OUTPUT 70903;"*CLS"
200    STOP
210SUBEND
```

NOTE *For information on an instrument's Status Byte and Standard Event Status registers, refer to the Agilent E1406 Command Module User's Manual or the "Beginner's Guide to SCPI" .*

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